

## **RESUME**

Full name: Izhak Bucher

Identity No. 057161499

Date and place of birth: Hadera, Israel. 22-April-1961

Marital status: Married + 2

Web site: <http://dynamics.net.technion.ac.il>

### **ACADEMIC DEGREES**

1993: DSc - Mechanical Engineering, Technion-Israel

1990: MSc - Mechanical Engineering, Technion-Israel

1987: BSc - Cum Laude, Mechanical Engineering, Technion-Israel,

### **ACADEMIC APPOINTMENTS**

2014 - Professor, Faculty of Mechanical Engineering, Technion

2004 - 2014 Associate Professor, Faculty of Mechanical Engineering, Technion

1999 - 2004 Senior Lecturer, Faculty of Mechanical Engineering, Technion

1996 - 1999 Lecturer, Faculty of Mechanical Engineering, Technion

1993 - 1996 Research associate, Department of Mechanical Engineering, Imperial College, London, UK

1987 - 1993 Graduate teaching assistant, Technion, Faculty of Mechanical Engineering

### **GUEST ACADEMIC APPOINTMENTS**

2014 Visiting professor, Mech. Eng., ENSAM, PARIS, France (sabbatical).

2013 Visiting professor, Mech. Eng., University of Campinas, Brazil (sabbatical).

2013 Visiting professor, Mech. Eng., University of British Columbia, Canada (sabbatical).

2003 Benjamin Meaker visiting professor, Aerospace Engineering, University of Bristol, UK.

2005 Japan Society for the Promotion of Science – invitation by Tokyo Technological Institute (Tokyo Tech), Japan. One month series of lectures

2013 Visiting Prof. (Planned) sabbatical at UBC Vancouver and ParisTech France for 12 month

### **RESEARCH INTERESTS**

- Vibration
- Dynamics of rotating structures
- Traveling wave excitation sensing and identification
- Acoustic levitation (near field)
- Experimental identification, signal processing and modeling of vibrating and rotating structures

## **TEACHING EXPERIENCE**

1. Dynamics of rotating machines, graduate-level
2. Microprocessor based product design, undergraduate
3. Project in Mechatronics, undergraduate
4. Modeling and identification in vibrating systems, graduate-level
5. Dynamics, undergraduate level
6. Theory of Vibration, undergraduate level

## **TECHNION ACTIVITIES**

- 2016-2018 Member, Continuing Education and External Studies steering committee  
 2014-2016 Member, Technion, Computing steering committee  
 2010-11,13 Head inter-departmental committee & program for design and manufacturing  
 2011-12 Member inter-departmental committee & program for design and manufacturing

## **DEPARTMENTAL ACTIVITIES**

- 2014-15 Associate Dean for Undergraduate Studies (Mech. Eng.)  
 2004-05 Associate Dean for Undergraduate Studies (Mech. Eng.)  
 2005-06 Coordinator of Undergraduate Studies (Mech. Eng.)  
 1996-16 Acting head of the Dynamics and Mechatronics Laboratory.

## **PUBLIC PROFESSIONAL ACTIVITIES**

- 2011- Elected member, Scientific committee for: ISMA Noise and Vibration Engineering Conference, held bi-annually in Leuven, Belgium  
 2012 Guest editor for *Mechanical Systems and Signal Processing*, special issue on 'Traveling waves in mechanical structures, sensing, control, identification and applications'  
 2014- Associate Editor, American Society of Mechanical Engineers (ASME), Journal of Vibration and Acoustics (commencing 9/2014).

## **MEMBERSHIP IN PROFESSIONAL SOCIETIES**

- ASME -American Society of Mechanical Engineering  
 SPIE - The international society for optics and photonics  
 SEM – Society for Experimental Mechanics  
 IFToMM - International Federation for the Promotion of Mechanism and Machine Science

## **REVIEWERS FOR JOURNALS**

Journal of sound and vibration, Mechanical Systems and Signal processing, IEEE Transactions on Control Systems Technology, Journal of Intelligent Material Systems and Structures, International Journal of Rotating Machinery, Shock and Vibration, Journal of Vibration and Acoustics, Chinese Journal of Aeronautics, Proceedings of the Royal Society A, Journal of Applied Mechanics, J. Micromechanics Microengineering, Int. J. Solids and Structures, IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, Journal of the Acoustical Society of America, Structural and Multidisciplinary Optimization.

## **HONORS**

- 2012 Citation for excellent teaching, (034011) “Theory of vibration”
- 2004 Alexander Goldberg Prize for Research, (\$3000)
- 2004 Solomon Simon Mani excellence in teaching award, (Grant \$3000)
- 2001 Excellence in teaching award, (035032) “Microprocessor based product design”, granted by the student association
- 1999 Muriel and David Jacknow Award (for excellence in teaching) , (\$2500)
- 1998 Samuel & Miriam Wein Academic Lecturer - Grant, (\$2500)
- 1996/7 Jacob Ullman memorial academic lectureship in manufacturing systems and robotics research – Grant (2 times),

## **GRADUATE STUDENTS**

### **Completed Theses**

#### **Msc**

- 1) Ronny Lazarovitch (2001)  
“Identification and location of cracks using electrical methods”, (co-supervisor Prof. D. Rittel),  
Currently: Group leader at Rafael
- 2) Oded Wertheim (2002)  
"Investigating the effect of vibration waves on the relative sliding motion of bodies"  
Currently: Business development manager, Ortal precision magnesium casting
- 3) Arie Elka (2003)  
“Investigating the dynamics of vibrating micro-mechanical structures”
- 4) Ran Gabay (2003)  
“Resonance tracking in a nonlinear squeeze-film levitation device”
- 5) Gabriele Vigevani (2004)  
”Multi DOF micro scanning mirror”,  
(co-supervised with Prof. A. Cigada<sup>†</sup> from Politecnico Milano)  
Currently: Completed PhD at Berkeley, now MEMS research Engineer at Sand9, Boston
- 6) Ofer Shomer (2005)  
“Fault detection in electro-magnetically suspended rotating structures”  
Currently: Control engineer, Rafael
- 7) Or Yogev (2005)  
“Experimental and analytical investigation of dynamic lateral torsional post-buckling of an elastic beam-mass system using the theory of a Cosserat point”,  
(co-supervised with Prof. M.B. Rubin<sup>†</sup>)  
Currently: CEO Startup Company developing solar energy storage systems
- 8) Hadar Raz (2008)  
"Numerical modeling of a squeeze film levitated micro-valve"  
Currently: Testing and analysis engineer at Plasan

### Completed Theses/Msc (cont.)

- 9) Eyal Bakalu (2009)  
A comparison between direct monitoring of vibrations in mechanical systems and the measurement of acoustical noise, (co-supervisor the Late Dr. Y. Porat)
- 10) Meir Mergi (2010)  
The influence of residual stresses and geometry changes on natural frequencies in thermally stressed bimetal rectangular beam, (co-supervisor Prof. D. Rittel)
- 11) Dan Magazinnik (2013), The dynamics of coupled sea-waves and an energy harvesting system
- 12) Yuri Trakht (2013), Study of parametric excitation of waves in ring-like solids
- 13) Dotan Ilssar (2014), Analysis and control of acoustic levitation: gap control and transportation
- 14) Noam Barak (2015), Investigating the Dynamics of an Electromagnetically Damped Rotating System, (co-supervisor Dr. Naftali Sela)
- 15) Ben Farkash (2016), Obtaining large amplitude traveling waves by switching between buckling Modes (co-supervisor Dr. Ran Gabai and Dr. Plat Harel)

### Master in Engineering (ME)

- 1) Moshe Rosenstein (1999)  
The dynamics of vibrating structures coupled to electromagnetic exciters,  
Currently: Mechanical Engineer at Rafael
- 2) Yaron Orbach (2007)  
Investigating the dynamical behavior of a mobile vehicle having a robotic arm,  
Currently: Development engineer, Israeli police

### PhD

- 1) Adi Minkes (2005)  
Non-contacting levitation and transportation using ultrasonic vibrations analytical, numerical and experimental study,  
Currently: Senior Research Engineer Area manager, Rafael
- 2) Arie Elka (2007)  
A synthesis and modeling approach for micro-electromechanical filters using structural Dynamics,  
Currently: Group leader and manager, Vibration & NDT testing, Rafael
- 3) Ran Gabai (2009)  
Multi-dimensional traveling waves generation and control,  
Currently: CTO, in a company developing a "Coriolis type flow-sensor"
- 4) Harel Plat (2012)  
Methods for Sensing and Creating Propagating Waves and Vibrations Using Parametric Excitation, Currently: Group leader and System Engineer, Rafael
- 5) Eyal Setter (2013)  
Traveling wave dynamics modeling and identification,  
Currently: Research Engineer, Rafael
- 6) Danila Meimukhin (2013)  
Optimization of a bi-stable energy harvesting oscillator under band-limited stochastic excitation,  
Currently: Research engineer, Elbit
- 7) Nadav Cohen (2013)  
Dynamics of an inner body energy harvesting device for a smart pill,  
Currently: Independent consultant/Flextronics

## **Theses in Progress**

### **MSc**

- 1) Idan Shadmi, Acoustically levitated bearings, Expected graduation 1/2017
- 2) Yoav Vered, Investigating the dynamics of fluid and solid enclosure in a wave-tube for characterization and determination of absorption and reflection coefficients, Expected graduation 10/2017
- 3) Alex Ferdinskoif, Comparing experimental and simulated dynamics of a micro turbo-jet engine rotor model, Expected graduation 8/2017
- 4) Netanel Ariel, Auto-Tuning and locking onto vibration modes, based on marginally stable closed-loop, applications analyzing and diagnostic rotating dynamical systems, Expected graduation 10/2017

### **PhD**

- 1) Amit Dolev, A parametrically excited amplifier for selective detection in distributed systems and altering the radiated acoustic spectrum, Expected graduation 7/2018
- 2) Dotan Ilssar, Analysis and control of acoustic levitation: gap control and transportation, Expected graduation 7/2017
- 3) Shachar Tresser, Detecting distributed mass unbalance at low speeds with nonlinear parametric excitation, Expected graduation 10/2017
- 4) Solomon Davis, Adjustable Acoustic Levitation and Transportation Using Ultrasonic Vibration, Expected graduation 10/2018

## **RESEARCH GRANTS<sup>4</sup>**

2016-17 MAFAT - R&D Directorate of the Israel Ministry of Defense – Navy  
 Title: Impedance characterization of materials using a novel pulse tube  
 Amount: 228,205 NIS per year

2016-17 The Israeli office of commerce – Magnet program (METRO 450)  
 Title: Fast identification of nonlinear dynamics structures  
 Amount: circa 356,232 NIS /year (years 4,5 of research)  
 Participants: Intel, Jordan Valley, Applied materials, Nova, Intel

2016-17 The Israeli office of commerce – Magnet program (METRO 450)  
 Title: Acoustic levitation and propulsion of silicon wafers  
 Amount: circa 452,840 NIS /year (years 4,5 of research)  
 Participants: Intel, Jordan Valley, Applied materials, Nova, Intel

2015-16 MAFAT - R&D Directorate of the Israel Ministry of Defense – Navy  
 Title: Radiation and vibration of submerged bodies.  
 Amount: 228,205 NIS

2015-16 Rafael & R&D Directorate of the Israel Ministry of Defense  
 Title: Auto-tuning and locking onto vibration modes, based on marginally stable closed-loop  
 Amount: 150,000 NIS

**RESEARCH GRANTS (Cont.)**

2014-17 The Israeli Science ministry– National program for Engineering and applied research  
 Title: Modeling and Control of near-field acoustically levitated objects  
 Amount: 850,000 NIS (3 years research)

2014-17 Brazilian CNPq/MCTI -- Ciências sem Fronteiras (Science without frontiers)  
 Title: CONTROLE DE MANIPULADORES FLEXÍVEIS.  
 Amount: R\$ 385,000 (about \$160,000)  
 Participants: Prof. Katia Lucchesi Cavalca Dedini, Paulo Kurka, Izhak Bucher

2013-15 MAFAT - R&D Directorate of the Israel Ministry of Defense – Navy  
 Title: Radiation and vibration of submerged bodies.  
 Amount: \$60,000 per annum

2010-15 MAFAT - R&D Directorate of the Israel Ministry of Defense  
 Title: Establishing a national center of excellence for Dynamics of rotating machines.  
 Amount: circa \$60,000- \$90,000 per annum

2012-13 Rafael & R&D Directorate of the Israel Ministry of Defense  
 Title: Dynamics of an electromagnetically damped vibration in rotating machines  
 Amount: \$75,000

2012-15 The Israeli office of commerce – Magnet program (METRO 450)  
 Title: Fast identification of nonlinear dynamics structures  
 Amount: circa 82,000 USD /year (3-5 years research)  
 Participants: Intel, Jordan Valley, Applied materials, Nova, Intel

2012-15 The Israeli office of commerce – Magnet program (METRO 450)  
 Title: Acoustic levitation and propulsion of silicon wafers  
 Amount: circa 110,000 USD /year (3-5 years research)  
 Participants: Intel, Jordan Valley, Applied materials, Nova, Intel

2010-12 Rafael  
 Title: Dynamics of an electromagnetic damper for rotating shafts  
 Amount: \$35,000

2009-10 R&D Directorate of the Israel Ministry of Defense  
 Title: Dynamics of small jet engines,  
 Amount: \$36,000/year  
 Participants: Rafael, Israeli jet engine manufacturers

2007-10 The Israeli office of commerce – Magnet program (BMP)  
 Title: Bio-medical photonics,  
 Research topic: Energy scavenging from the human intestine during a SmartPill  
 Voyage though the body  
 Amount: \$85,000/year  
 Participants: Sheba hospital, GivenImaging, (other high-tech industries)

**RESEARCH GRANTS (Cont.)**

- 2006-8 Azimut Technologies  
 Title: Dynamics and error mechanisms of a north seeking coriolis device,  
 Amount: 25,000 USD/year
- 2005-8 **The Israel Science Foundation (ISF)**  
 Title: Non-contacting levitation and transportation of objects using high-frequency  
 pressure traveling waves  
 Amount: 180,000 USD
- 2003-06 **The European community (sixth framework)**, Network of excellence.  
 Title: Advanced MEMS for RF and Millimeter Wave Communication  
 Researchers: David Elata (principal researcher), Izhak Bucher  
 Amount: 40,000 USD /year  
 Participants: Leading European universities
- 2002-07 The Israeli office of commerce – Magnet program (MOEMS).  
 Title: Dynamical models for compound Micro Electro-Mechanical Systems  
 Amount: 100,000 USD /year  
 Participants: In collaboration with Israeli hi-tech industries, Elop, Rafael
- 2002-06 **The European community (Fifth framework)**.  
 Title: Magnetic bearings for smart aero engines  
 Amount: 350,000 Euro  
 Participants: Imperial-College, ETH-Zurich, TU-Darmstadt, Snecma/Turbo-Mecca
- 1997-01 **The Israel Science Foundation (ISF)**  
 Title: Development of identification and fault-detection methods for non-linear  
 time-varying rotating systems  
 Amount: 180,000 USD
- 1998-00 Niedersächsische Ministerium für Wissenschaft und Kultur,  
 Title: A new precision linear drive system using a micro actuator  
 Amount: 122,000 DM
- 2001-03 Cooperation scheme with the "Conference des Grandes Ecoles",  
 Title: "Optimal structure design by means of geometrical modification",  
 Cooperation with Prof. E. Balmes Ecole Centrale Paris.  
 Amount: circa 1000 Euro per visit.

## **PUBLICATIONS**

### **Refereed papers in professional journals**

- 1) I. Bucher, S. Braun (1992), "A model-based method for ranking measured channels", *Mechanical Systems and Signal Processing*, 6, 433-446.
- 2) I. Bucher, S. Braun (1993), "The structural modification inverse problem: an exact solution", *Mechanical Systems and Signal Processing*, 7, 217-238.
- 3) I. Bucher, S. Braun (1994), "Efficient optimization procedure for minimizing vibratory response via redesign or modification", part I: theory, *Journal of Sound and Vibration*, 175, 433-453.
- 4) I. Bucher and S.G. Braun (1994), "Efficient optimization procedure for minimizing the vibratory response via redesign or modification, part II: Examples", *Journal of Sound and Vibration*, 175, 455-476.
- 5) I. Bucher, S. Braun (1997), "Left eigenvectors: extraction from measurements and physical interpretation", *Journal of Applied Mechanics*, 64, 97.
- 6) I. Bucher, D. Ewins (1997), "Multidimensional decomposition of time-varying vibration response signals in rotating machinery", *Mechanical Systems and Signal Processing*, 11, 577-601.
- 7) I. Bucher (1998), "Exact adjustment of dynamic forces in presence of non-linear feedback and singularity-Theory and algorithm", *Journal of sound and vibration*, 218, 1-27.
- 8) I. Bucher, O. Wertheim (2000), "Measuring spatial vibration using continuous laser scanning", *Shock and Vibration*, 7, 203-208.
- 9) I. Bucher, D.J. Ewins (2001), "Modal analysis and testing of rotating structures", *Philosophical Transactions of the Royal Society of London. Series A: Mathematical, Physical and Engineering Sciences*, 359, 61-96.
- 10) I. Bucher (2002), "Parametric optimization of structures under combined base motion direct forces and static loading", *Journal of vibration and acoustics*, 124, 132-140.
- 11) R. Lazarovitch, D. Rittel, I. Bucher (2002), "Experimental crack identification using electrical impedance tomography", *NDT & E International*, 35, 301-316.
- 12) A. Minikes, I. Bucher (2003), "Coupled dynamics of a squeeze-film levitated mass and a vibrating piezoelectric disc: numerical analysis and experimental study", *Journal of sound and vibration*, 263, 241-268.
- 13) A. Minikes, I. Bucher (2003), "Noncontacting lateral transportation using gas squeeze film generated by flexural traveling waves—Numerical analysis", *The Journal of the Acoustical Society of America*, 113, 2464-2473.
- 14) Y. Halevi, I. Bucher (2003), "Model updating via weighted reference basis with connectivity constraints", *Journal of sound and vibration*, 265, 561-581.

### **Refereed papers in professional journals (cont.)**

- 15) I. Bucher, Y. Zimmerman<sup>1</sup>, G. Vigevani, M. Velger<sup>2</sup>, R. Erlich<sup>2</sup> (2003), “Design and Analysis of Multi-DOF Micro-Mirror for Triangular Wave Scanning”, *Journal of the Mechanical Behavior of Materials*, 14, 369-382.
- 16) A. Minikes, I. Bucher, S. Haber (2004), “Levitation force induced by pressure radiation in gas squeeze films”, *The Journal of the Acoustical Society of America*, 116, 217-226.
- 17) I. Bucher (2004), “Estimating the ratio between travelling and standing vibration waves under non-stationary conditions”, *Journal of Sound and Vibration*, 270, 341-359.
- 18) A. Minikes, R. Gabay, I. Bucher, M. Feldman<sup>3</sup> (2005), “On the sensing and tuning of progressive structural vibration waves”, *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, 52, 1565-1576.
- 19) A. Minikes, I. Bucher, G. Avivi (2005), “Damping of a micro-resonator torsion mirror in rarefied gas ambient”, *Journal of Micromechanics and Microengineering*, 15, 1762-1769.
- 20) A. Minikes, I. Bucher (2006), “Comparing numerical and analytical solutions for squeeze-film levitation force”, *Journal of fluids and structures*, 22, 713-719.
- 21) R. Gabay, I. Bucher (2006), “Resonance tracking in a squeeze-film levitation device”, *Mechanical systems and signal processing*, 20, 1696-1724.
- 22) I. Bucher, M. Rosenstein (2006), “Determination of External Forces—Application to the Calibration of an Electromagnetic Actuator”, *Journal of vibration and acoustics*, 128, 545-554.
- 23) O. Yogev, M. Rubin, I. Bucher (2007), “Dynamic lateral torsional post-buckling of a beam-mass system: Theory”, *Journal of Sound and Vibration*, 303, 832-857.
- 24) O. Yogev, I. Bucher, M. Rubin (2007), “Dynamic lateral torsional post-buckling of a beam-mass system: Experiments”, *Journal of Sound and Vibration*, 299, 1049-1073.
- 25) G. Avivi, I. Bucher (2008), “A method for reducing the inaccuracy of harmonic ratios in the dynamics of a multiple-degrees-of-freedom MEMS scanning mirror”, *Journal of Micromechanics and Microengineering*, 18, 025028. <http://iopscience.iop.org/0960-1317/18/2/025028>
- 26) A. Elka, I. Bucher (2008), “On the synthesis of micro-electromechanical filters using structural dynamics”, *Journal of Micromechanics and Microengineering*, 18, 125018.
- 27) R. Gabai, I. Bucher (2009), “Excitation and sensing of multiple vibrating traveling waves in one-dimensional structures”, *Journal of Sound and Vibration*, 319, 406-425.
- 28) A. Elka, I. Bucher (2009), “Optimal electrode shaping for precise modal electromechanical filtering”, *Structural and Multidisciplinary Optimization*, 38, 627-641.
- 29) M. Feldman<sup>3</sup>, I. Bucher, J. Rotberg<sup>3</sup> (2009), “Experimental identification of nonlinearities under free and forced vibration using the Hilbert transform”, *Journal of Vibration and Control*, 15, 1563-1579.

- 30) I. Bucher (2009), “A Mechanical Fourier series Generator: An Exact Solution”, Journal of Vibration and Acoustics, 131, 031012. <http://dx.doi.org/10.1115/1.3085892>
- 31) R. Gabai, I. Bucher (2010), “Spatial and Temporal Excitation to Generate Traveling Waves in Structures”, Journal of Applied Mechanics, 77, 021010.
- 32) E. Setter, I. Bucher (2011), “Flexural vibration patterning using an array of actuators”, Journal of Sound and Vibration, 330, 1121-1140.
- 33) I. Bucher (2011), “Transforming and separating rotating disk vibrations using a sensor array”, Journal of Sound and Vibration, 330, 1244-1264.
- 34) N. Cohen, I. Bucher, M. Feldman<sup>3</sup> (2012), “Slow-fast response decomposition of a bi-stable energy harvester”, Mechanical Systems and Signal Processing, 31, 29-39.
- 35) E. Setter, I. Bucher, S. Haber (2012), “Low-Reynolds-number swimmer utilizing surface traveling waves: Analytical and experimental study”, Physical Review E, 85, 066304.
- 36) H. Plat and I. Bucher (2013), “Optimizing parametric oscillators with tunable boundary conditions”, Journal of sound and Vibration, 332, 487–493.
- 37) D. Meimukhin, I. Bucher and N. Cohen (2013), “On the efficiency of energy harvesters under band-limited random excitation”, Journal of Intelligent Material Systems and Structures, doi: 10.1177/1045389X13484102
- 38) I. Bucher (2013), “Directional Order Tracking in Rotating Machines”, Journal of Vibration and Acoustics, 135, 061004. doi: 10.1115/1.4024052
- 39) E. Setter and I. Bucher (2013), “A minimal-torque wave-generating mechanism for fluid manipulation”, Mechanism and Machine Theory, doi: 10.1016/j.mechmachtheory.2013.07.017
- 40) I. Bucher and O. Shomer (2013), “Asymmetry identification in rotating bodies – theory and experiment”, Mechanical Systems and Signal Processing, doi: 10.1016/j.ymsp.2013.07.014
- 41) H. Plat and I. Bucher (2013), “Parametric excitation of traveling waves in a circular non-dispersive medium”, Journal of Sound and Vibration, doi: 10.1016/j.jsv.2013.11.005
- 42) I. Bucher and O. Halevi (2013), “Optimal calibration of nonlinear, delayed sensors”, Mechanical Systems and Signal Processing, doi: 10.1016/j.ymsp.2013.12.008
- 43) E. Setter, I. Bucher and S. Haber (2014), “Experimental investigation of propulsion by multiple surface traveling waves at low Reynolds numbers”, Mechanical Engineering Science, online February 12, 2014, doi: 10.1177/0954406214523580
- 44) N. Cohen and I. Bucher (2014), “On the dynamics and optimization of a non-smooth bistable oscillator – Application to energy harvesting”, Journal of sound and Vibration, 333, 4653–4667, doi: 10.1016/j.jsv.2014.04.006

### **Refereed papers in professional journals (cont.)**

- 45) D. Ilssar and I. Bucher (2015), “On the slow dynamics of near-field acoustically levitated objects under high excitation frequencies”, *Journal of Sound and Vibration*, doi:10.1016/j.jsv.2015.05.020
- 46) A. Dolev and I. Bucher (2016), “Tunable, Non-Degenerated, Nonlinear, Parametrically-Excited Amplifier”, *Journal of Sound and Vibration*, Volume 361, Pages 176–189, doi:10.1016/j.jsv.2015.09.048
- 47) M. Feldman, Y. Zimmerman, M. Gissin, I. Bucher (2016), “Identification and modeling of contact dynamics of precise direct drive stages”, *Journal of Dynamic Systems, Measurement and Control*, 138(7):071001-071001-10. doi:10.1115/1.4033017
- 47) A. Dolev and I. Bucher (2016), “Experimental and Numerical Validation of Digital, Electromechanical, Parametrically Excited Amplifiers”, *Journal of Vibration and Acoustics*, 138(6), 071001 (June 05, 2016), doi:10.1115/1.4033897
- 48) R Gabai, D Ilssar, R Shaham, N Cohen and I Bucher (2016), “A rotational traveling-wave based levitation device–Modelling, design, and control”, *Sensors and Actuators A: Physical*, in press (12/2016)
- 49) D. Ilssar, I. Bucher and Henryk Flashner (2017), “Modeling and closed loop control of near-field acoustically levitated objects”, *Mechanical Systems and Signal Processing*, Volume 85, Pages 367–381, <http://dx.doi.org/10.1016/j.ymssp.2016.08.011>

### **Editorial**

I. Bucher (2013), “Editorial - Traveling waves: signal processing, control, modeling, identification, dynamics and applications in mechanics and engineering”, *Mechanical Systems and Signal Processing* 39 (2013) pp. 1-2

### **Patents**

- 2007 “A method for eliminating the inaccuracy of natural frequency multiplications in a multi DOF micro scanning mirror”, WIPO Patent Application WO/2009/024987.
- 2011 "Oscillating mirror having a plurality of eigenmodes", With Marko Velger – ELOP. US patent No. 8,054,522.
- 2012a "System and method for active detection of asymmetry in rotating structures" US 8,272,265 B2. With O. Shomer. (cited in *Acoustical Patents: The Journal of the Acoustical Society of America*, 133(4), pp. 2514-2514.)
- 2012b “A minimal-torque, wave-generating, propelling & pumping mechanism”, Described and claimed in Provisional Patent Application No. 61/601,629 (filed: Feb. 22, 2012). With E. Setter.

### **Research reports or Case reports**

- 2012 Comparing jet engine dynamics under various configurations of 2 design options – Invited survey and report by Mafat (governmental) agency
- 2013 Passive electrodynamic damping and bearings for fast rotating machines – Rafael

## CONFERENCES

### Plenary, keynote or invited talks

- 2001 "Dynamics of rotating Machinery" – **Plenary** lecture, DINAME, international conference, FLORIANOPOLIS, Brazil, March 5-9
- 2009a "Tailoring the dynamics of a MEMS scanning mirror" – **Keynote** lecture, DINAME, international conference, Angra dos Reis, Brazil, March 1-6
- 2009b "Experimental Decomposition of Vibration, Whirl and Waves in Rotating and Non-Rotating Parts"– IUTAM Symposium on Emerging Trends in Rotor Dynamics, **Invited**. Indian Institute of Technology, Delhi, India, March 23-26, 2009
- 2012 "Model based signal processing in Smart rotating machines" – **Keynote** lecture, 10th International Conference on Vibrations in Rotating Machinery, London, UK, Sep 11-13

### Refereed papers in conference proceedings (10 recent years)

- R. Gabay\* and I. Bucher (2006), "Generating 1D and 2D directional vibration waves", International Modal analysis conference, ISMA, Leuven Belgium, September
- O. Yogev, I. Bucher\* and M.B. Rubin (2006), "Experiments, measurement procedures and curve-fitting of a post-buckled vibrating beam", International Modal analysis conference, Leuven Belgium, September
- R. Gabay\* and I. Bucher (2006), "On vibrating traveling waves actuation, sensing and, tuning, in finite structures", International Mechanical Engineering Congress, ASME, Chicago Illinois USA, November
- O. Yogev, I. Bucher\* and M.B. Rubin (2006), "On the dynamics of a post-buckled vibrating beam", International Mechanical Engineering Congress, ASME, Chicago Illinois USA, November
- I. Bucher\* and G. Avivi (2007), "Mechanical Fourier series generator – Theory and practice", International Mechanical Engineering Congress, ASME, Las-Vegas Nevada USA, September
- R. Gabai\*, I. Bucher (2008), "Generating Traveling Vibration Waves in Finite Structures", Biennial ASME Conference on Engineering Systems Design and Analysis, (ESDA), ASME, Haifa Israel, July
- A. Elka\*, I. Bucher (2008), "Optimal Electrode Shaping for Precise Modal Electromechanical Filtering", Engineering Systems Design and Analysis Conference, (ESDA), ASME, Haifa Israel, July
- I. Bucher\* and A. Elka (2008), "Balancing an asymmetric north seeking device", International conference on Vibration in Rotating Machinery, IMechE, Exeter UK, September
- I. Bucher\* and A. Elka, (2008), "Mechanical filters – trimming and optimization", International Conference on Noise and Vibration Engineering, ISMA, Leuven Belgium, September

**Refereed papers in conference proceedings (10 recent years, cont.)**

- I. Bucher\* (2010), “Real Time Decomposition of Disk Vibrations”, 8th IFToMM International Conference on Rotordynamics, Seoul Korea, September
- E. Setter\* and I. Bucher (2010), “Elastic travelling waves in multi-dimensional structures with application to self-propulsion”, International Conference on Noise and Vibration Engineering, ISMA, Leuven Belgium, September
- N. Cohen\* and I. Bucher (2010), “An energy harvesting mechanism travelling the human intestinal system”, International Conference on Noise and Vibration Engineering, ISMA, Leuven Belgium, September
- N. Cohen and I. Bucher\* and D. Meimukhin (2011), “Low-frequency energy harvesting exploiting nonlinear coupling”, 7th European Nonlinear Dynamics Conference, ENOC, Rome Italy, July
- E. Setter and I. Bucher\* (2011), “A Micro-scale swimmer propelled by traveling surface waves”, Symposium on Dynamics of MEMS and NEMS part of the 5th International Conference on Micro- and Nanosystems (MNS,) ASME, Washington DC, USA, August
- E. Setter\* and I. Bucher (2012), “An optimal waving device utilized in micro swimmer/pump: analytical, numerical and experimental analysis”, Biennial ASME Conference on Engineering Systems Design and Analysis, (ESDA), ASME, Nantes France, July
- N. Cohen\* and I. Bucher (2012), “The dynamics of a bi-stable energy harvester: exploration via slow-fast decomposition and analytical modeling”, Biennial ASME Conference on Engineering Systems Design and Analysis, (ESDA), ASME, Nantes, France, July
- I. Bucher\* and H. Plat (2012), “Achieving large amplitude and traveling vibrations waves via parametric excitation”, International Conference on Noise and Vibration Engineering, ISMA, Leuven Belgium, September
- I. Bucher\* (2013), “Modeling and experiments of double-well nonlinear oscillator for energy harvesting”, The 4th Canadian Conference on Nonlinear Solid Mechanics (CanCNSM 2013) McGill University, July 23-26, 2013, Montreal, Canada
- I. Bucher\*, D. Ilssar and N. Cohen (2014), “Near-field acoustic levitation and non-contacting translation with traveling waves”, XIX Symposium VISHNO, June 17-19, Vibration SHock and Noise, Aix en Provence, France
- I. Bucher\* and O. Halevi (2014), “A phase calibration method for memoryless nonlinear systems”, International Conference on Noise and Vibration Engineering, ISMA, Leuven Belgium, September
- D. Ilssar and I. Bucher (2014), “Structural optimization for one dimensional acoustic levitation devices - Numerical and experimental study”, International Conference on Noise and Vibration Engineering, ISMA, Leuven Belgium, September

### **Refereed papers in conference proceedings (10 recent years, cont.)**

- I. Bucher and A. Dolev (2015), “A new paradigm for parametric mechanical amplifiers”, DINAME XVII, International Symposium on Dynamic Problems of Mechanics, Natal, RN, Brazil, February 22-27, 2015
- A. Dolev and I. Bucher (2015), “A Parametric Amplifier for Weak, Low-Frequency Forces”, ASME 2015 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2015), August 2-5, Boston, USA
- Izhak Bucher, Dotan Ilssar, Ran Gabai, Nadav Cohen, Ran Shaham and Solomon Davis, “Controlled Acoustic Levitation – Physical Model and Real-Time Digital Implementation”, AIM 2016, July 12-16 Banff, Canada IEEE International Conference on Advanced Intelligent Mechatronics, July 12–15, 2016, Banff, Alberta, Canada
- S. Tresser and I. Bucher (2016), A method for balancing high-speed rotors using low rotation speed measured data through parametric excitation, International conference on Vibration in Rotating Machinery, IMechE, Manchester, UK
- A. Dolev and I. Bucher (2016), “Analytical, numerical and experimental investigation of a tunable, nonlinear multi-degree-of-freedom parametrically excited amplifier”, International Conference on Noise and Vibration Engineering, ISMA, Leuven Belgium, September
- D. Ilssar and I. Bucher (2016), “Model based, nonlinear control of near-field acoustically levitated objects”, International Conference on Noise and Vibration Engineering, ISMA, Leuven Belgium, September

### **SEMINARS (invited)**

- "The effect of feedback on bias in force tuning", Virginia Polytechnic Institute – Mechanical Engineering, February 1998, Host: Prof. Larry D. Mitchell
- "Dynamics and Identification of Rotating Structures", Penn State University, Mechanical Engineering – USA, February 1998, Host: Prof. Martin Trethewey
- "Tuning a response pattern with an array of excitation devices", Purdue University, School of Mechanical engineering, February 1998, Host: Dr. Patricia Davies
- "Rotating Machinery modeling, Identification and Unsolved Problems", Institut für Techno- und Wirtschaftsmathematik, University of Kaiserslautern, Germany, September 1998, Host: Dr. Susanne, Seibold
- "On the Identification, signal processing and modal testing of rotating structures", University of Virginia, Mechanical engineering, February 2001, Host: Prof. Paul Allaire
- "On the effect of vibration on friction", February 2001, Center for Intelligent Material Systems and Structures, Virginia Polytechnic Institute-USA, Host: Prof. Dan Inman
- "Separating Traveling and Standing Vibration waves ", University of Roma Italy - La-Sapienza, Mechanical engineering, July 2002, Host: Prof. Aldo Sestieri
- "Tailoring the dynamics of a miniature (MEMS) scanning mirror", University of Southern California, March 2004, Host: Prof. H. Flashner
- "On the dynamics and control of a MDOF scanning mirror", Stanford University, EE department, March 2004, Host: Prof. O. Solgaard
- "Identification and design control of a MDOF scanning mirror", University of California at San-Diego, March 2004, Host: Dr. Raimond de Callafon

**SEMINARS (invited)(cont.)**

- "Tailoring the dynamics of a miniature (MEMS) scanning mirror", University of California at Los Angeles, March 2004, Host: Prof. R. M'closkey
- "On a MEMS mechanical Fourier series generator – application to a scanning mirror", University of Liege Belgium, December 2004, Host: Prof. J.C. Golinval
- "Tailoring the dynamics of a miniature (MEMS) scanning mirror", July 2006, University of Besancon, France, Host: Dr. Scott Cogan
- "On the dynamics of a MDOF MEMS mirror", November 2006, Michigan State University, Host: Profs. Steve Shaw and Brian Feeny
- "The Mechanical Fourier series generator – tailoring the dynamics", October 2008, University of Virginia Charlottesville, Host: Prof. Eric Maslen
- "Body energy harvesting using a vibrating frequency up-conversion mechanism", Tokyo Institute of Technology, September 2010, Host Prof. M. Okuma
- "Dynamics of a MDOF MEMS device", Politecnico Torino, Italy. September 2010, Host: Prof. A. Tonoli
- "Acoustic levitation and transportation", ParisTech, France. July 2012, Host: Prof. E. Balmes
- "Mechanical Optimization of a scanning mirror", UBC, Vancouver. October 2013, Host: Prof. S. Phani
- "Optimizing Mechanical vibrating devices", Washington state university, Seattle. November 2013, Host: Prof. I. Y. Shen.
- "Progress on Acoustic levitation and transportation", ParisTech, France. July 2012, Host: Prof. E. Balmes
- "A mechanical signal processing MEMS mirror", University of Lyon (INSA), Lyon. July 2014, Host: Prof. J. Antoni
- "Acoustic levitation and propulsion in several degrees of freedom", University of Lille. Sep, 2016, Host: Prof. Frédéric Giraud