CURRICULUM VITAE

- **Personal Details**

Chen Dubi (חן דובי)

Born 4 April 1973

Home address: Atad 40 Beer sheva, 84844, Israel, Tel. 050-6226552

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- **Education**

B. Sc.- 1995-1998, Department of Mathematics and Computer science, Ben-Gurion University of the Negev (BGU).

M. Sc. - 1998-2000, Department of Mathematics, Ben-Gurion University of the Negev.

Name of advisor: Prof. Itzhak Rubinstein

Thesis title: "Limiting Current in Electro-diffusion"

Ph.D - 2000-2004, Department of Mathematics, Ben-Gurion University of the Negev.

Name of advisor: Prof. Daniel Alpay

Thesis title: "Reproducing kernel Hilbert spaces: interpolation, realization and related topics"

- **Employment History**

2017-2018: Sabbatical period (starting Sep. 2017) at the Veterbi Faculty of Electrical Engineering, Technion, Haifa.

2017-current: Adjunct faculty member, Dept. of Mathematics, Ben-Gurion University of the Negev. Academic Rank: Professor .

2009-current: Research position at the Nuclear Research Center Negev (NRCN), Department of Physics. Rank: A (א' מחקר).

2005-2008: Lecturer (research position) at the Shamoon College of Engineering (SCE), Mathematics unit.

2004-2005: Post-doctoral position at the Weizmann institute, Dept. Of Mathematics. Host: Prof. Harry Dym.

- **Professional activities**

Membership in professional\scientific societies:

2011-current: member of the Institute of Nuclear Material Management (INMM).

2015-current: Member of the Israeli Nuclear Society

Active Reviewer: Annals of Nuclear Energy, Nuclear Instruments & Methods-A.

- **Educational activities**

Courses taught

- Stochastic Processes in Nuclear Engineering (BGU, Dept. of Nuclear Engineering, 2017)
- Partial differential equations (BGU, Dept. Of mathematics, 2009)
- Introduction to probability theory (BGU, For Electrical Engineering students, 2009)
- Numerical methods in engineering (BGU, Dept. Of civil engineering, 2014)
- Calculus1 and 2 (SCE, For Electrical Engineering students, 2005-2008)
- Introduction to differential equations (SCE, For Electrical Engineering students, 2005-2008)
- Complex functions (SCE, For Electrical Engineering students, 2005-2008)
- Linear Algebra 1 (SCE, For Electrical Engineering students, 2005-2008)
- Vector analysis (SCE, For Electrical Engineering students, 2005-2008)

Graduate and Ph.D. committees

- Ph.D. accompanying committee: Oren Tal (under the supervision of Prof. Erez Gilad, Dept. of Nuclear Engineering, GBU, 2020-current)
- M.Sc. Examiner: Amir Ouday (under the supervision of Prof. Erez Gilad, Dept. of Nuclear Engineering, GBU, 2019)
- Ph.D. Examiner: Lajos Nagy (Under the supervision of Prof. Imre Paszit, High Energy and Plasma Physics, Chalmers University of Technology, Gothenburg, Sweden, and Prof. Mate Szieberth, Dept. of nuclear Technology, Budapest University of Technology and Economics (BME), 2021)

- **Research students**
  1. Tal Malinevitch, M.Sc., 2016. Ben-Gurion University, Dept. Of Mathematics. Joint supervision with prof. Ben Zion rubstien.
  2. Guy Heger, M.Sc., 2017, Dept. of Nuclear Engineering, BGU (co-supervised with Dr. Erez Gilad). Title: Mathematical methods for detecting neutron shielding in Neutron Multiplicity Counting.
  3. Yael Neiymair. M.Sc., 2017, Dept. of Nuclear Engineering, BGU (co-supervised with Dr. Erez Gilad). Title: Dead Time corrections on high moments of the neutron count distribution ant the Feynman-Y plot using the BEX method.
  4. Guy Stein. M. Sc., 2022. Ben-Gurion University, Dept. Of Mathematics. Title: The stabilization effect of non-linear feedback on the Stochastic Point Reactor Kinetic Equation.
  5. Eshed Magali, 2022- current, PhD. Dep. Of mathematics.

- **Award and honors**

  2002 Deans award for Ph.D students (single recipient).
  2011-2017 Katzir scholarship (Ministry of Defense)
  2018 NRCN manager excellent research award (single project annually, project leader)

- **Scientific publications summery**

  (a) H-index (ISI): 8 (GS-9)
  (b) Total number of citations (ISI): 157 (GS-254)
  (c) Total number of citations without self-citations (ISI): 105

- **Invited Talks:**
  1. 2017, Title of talk: "Mathematical analysis for identifying neutron shielding in Neutron Multiplicity Counting" ANS Mathematic & Computation (M&C), 16-20 May , Jeju, South Korea
  2. 2021, Title of talk: " The two point Feynman-alpha theory: A practical point of view on ex-core detectors", ANS Mathematic & Computation (M&C), 3-7 Oct., Virtual Conference.
- **Session Chair:**
  1. 2017, ANS Mathematic & Computation (M&C), 16-20 May , Jeju, South Korea.
  2. 2017, IPS2017- the 64th annual meeting of the Israel physical society, Dec. 17
  3. 2016, 28th Conference of the Nuclear Societies in Israel, 12-14 April, Dan Panaroma, Tel Aviv.
  4. 2018, 29th Conference of the Nuclear Societies in Israel, 8-10 May, Daniel Herzlia
  5. 2022, 30th Conference of the Nuclear Societies in Israel, 7-9 June, , Daniel Herzlia
- **Organizing committee:**
  1. 2018, 29th Conference of the Nuclear Societies in Israel, 8-10 May, Daniel Herzlia
  2. 2022, 30th Conference of the Nuclear Societies in Israel, 7-9 June, , Daniel Herzlia

- **Synopsis of research**

  Mathematical modeling of nuclear systems and fission chains may be roughly divided into two main categories: deterministic models, which describe the mean field of the neutron population, and stochastic models, which describes the distribution of the neutron population in its entirety.

  On one hand, the true nature of the neutron population is stochastic, and the population size, by essence, is a stochastic processes. On the other hand, a full mathematical treatment for the stochastic behavior is simply too complicated, and the proses cannot be analyzed in a complete fashion.

  Understanding the stochastic nature of the neutron population is both a fundamental problem in the theory of nuclear silences, and a subject with many applications in rector control and monitoring,

reactor experiments and non-destructive measurements of special nuclear materials.
In the past years, I have gained high expertise in advanced techniques in modeling the stochastic behavior of fission chains, both in theory and applications. On one hand, my strong mathematical background (with respect to most members of the nuclear engineering community) has provided me with a substantial mathematical "toolbox" which enables me to address state of the art problems from new directions. On the other hand, my current affiliation as an NRCN member, gives me access to international collaborations, allowing me to validate the new models through "hand on" experiments.
In more details, my research synopsis for the near future my de divided into three main categories:

1. **Advanced reactor noise modeling using the Probability Generating Function (PGF).**

   The PGF has turned to be a very powerful tool for understanding the stochastic nature of neutron population in a rector. While Feynman and De Hoffman described the foundations of the method over 70 years ago, it is still enjoying vast treatment through many contributors. In two recent publications, we have constructed a formal model for a multi energy spatial PGF [20] (reference refers to the list of publications), and analyzed the higher moment of the neutron distribution (and their applications) [23]. Still, both studies have left many open problems and many unsolved questions which we intend to pursue. In particular, the practical interpretation of the multi energy spatial PGF is still not fully understood, and is both a theoretical and implicational challenge.

2. **Advanced mathematical techniques in testing special nuclear materials and radiation measurements.**

   Special nuclear materials, by definition, emit neutrons. There for, the mere existence of a neutron flux may indicate the presence of a special nuclear material. As it turns out, while the different neutron sources emit neutrons with the same energy spectrum, the statistical nature of the different sources is often unique. There for, understanding the stochastic nature of fission chains is a basic problem in nuclear engineering. From a mathematical point of view, a fission chain may be studied as a continuous time Markovian branching process or continuous time Galton-Watson trees. In the recent years we have developed several models for analyzing the dynamic through time of fission chains in the this context [16,17,18,37] and developed mathematical methods for estimating the error propagation [28,30]. In addition, I currently interested in

implementation of the well-studied Renewal Theory to radiation measurements [33, Ref. 2 in "papers submitted"]

3. **Modeling rector noise via stochastic differential equations.**

   The theory of Stochastic Differential Equations (SDE) and the so called Ito calculus was introduced in the early 20s of the previous century, and since then, it has shown many fruitful applications in a vary of fields such as mechanical statistics, queuing theory, economy and more. Surprisingly, the theory was hardly implemented for modeling stochastic noises in reactors. In a collaboration with Prof. Rami Atar from the EE department in the Technion, a basic SDE was constructed to analyze flux fluctuations under the so-called Reactor Point Kinetic model [29]. The basic model was then extended to account for non-linear effects such as detector dead-time [32] and external mechanical vibrations [35]. In addition, the model was used to explain the stochastic stability of critical reactors (a problem noticed in the 70's of the previous century). At present, this topic is my main point of interest, and in particular, the use of SDE models to construct Monte-Carlo algorithms to compute high moments of nuclear systems with non-linear effects.