

RESUME

Full name: Izhak Bucher

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

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. 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. Vibration theory, undergraduate level

TECHNION ACTIVITIES

- 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.)
 1996-13 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’
 2012- Founding member, The Israeli Society for Structural health monitoring
 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

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

- Supervised 19 MSc and PhD students (see [former thesis](#))
 Currently supervising 8 MSc and PhD students

Selected papers in professional journals

- I. Bucher, S. Braun (1993), “The structural modification inverse problem: an exact solution”, *Mechanical Systems and Signal Processing*, 7, 217-238.
- 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.
- I. Bucher, S. Braun (1997), “Left eigenvectors: extraction from measurements and physical interpretation”, *Journal of Applied Mechanics*, 64, 97.
- I. Bucher, D. Ewins (1997), “Multidimensional decomposition of time-varying vibration response signals in rotating machinery”, *Mechanical Systems and Signal Processing*, 11, 577-601.
- 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.
- I. Bucher, O. Wertheim (2000), Measuring spatial vibration using continuous laser scanning, *Shock and Vibration*, 7, 203-208.
- 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.
- R. Lazarovitch, D. Rittel, I. Bucher (2002), “Experimental crack identification using electrical impedance tomography”, *NDT & E International*, 35, 301-316.
- 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.
- 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.
- 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.
- I. Bucher (2004), “Estimating the ratio between travelling and standing vibration waves under non-stationary conditions”, *Journal of Sound and Vibration*, 270, 341-359.
- A. Minikes, R. Gabay, I. Bucher, M. Feldman³ (2005), “On the sensing and tuning of progressive structural vibration waves”, *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, 52, 1565-1576.
- 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.

- A. Minikes, I. Bucher (2006), “Comparing numerical and analytical solutions for squeeze-film levitation force”, Journal of fluids and structures, 22, 713-719.
- R. Gabay, I. Bucher (2006), “Resonance tracking in a squeeze-film levitation device”, Mechanical systems and signal processing, 20, 1696-1724.
- 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>
- 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.
- A. Elka, I. Bucher (2009), “Optimal electrode shaping for precise modal electromechanical filtering”, Structural and Multidisciplinary Optimization, 38, 627-641.
- 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>
- R. Gabai, I. Bucher (2010), “Spatial and Temporal Excitation to Generate Traveling Waves in Structures”, Journal of Applied Mechanics, 77, 021010.
- E. Setter, I. Bucher (2011), “Flexural vibration patterning using an array of actuators”, Journal of Sound and Vibration, 330, 1121-1140.
- I. Bucher (2011), “Transforming and separating rotating disk vibrations using a sensor array”, Journal of Sound and Vibration, 330, 1244-1264.
- N. Cohen, I. Bucher, M. Feldman³ (2012), “Slow-fast response decomposition of a bi-stable energy harvester”, Mechanical Systems and Signal Processing, 31, 29-39.
- E. Setter, I. Bucher, S. Haber (2012), “Low-Reynolds-number swimmer utilizing surface traveling waves: Analytical and experimental study”, Physical Review E, 85, 066304.
- H. Plat and I. Bucher (2013), “Optimizing parametric oscillators with tunable boundary conditions”, Journal of sound and Vibration, 332, 487–493.
- I. Bucher (2013), “Directional Order Tracking in Rotating Machines”, Journal of Vibration and Acoustics, 135, 061004. doi: 10.1115/1.4024052
- 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
- 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

- 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
- 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
- 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
- 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
- A. Dolev and I. Bucher (2015), “Tunable, Non-Degenerated, Nonlinear, Parametrically-Excited Amplifier”, *Journal of Sound and Vibration*, doi:10.1016/j.jsv.2015.09.048
- M. Feldman, Y. Zimmerman, M. Gissin, I. Bucher, “Identification and modeling of contact dynamics of precise direct drive stages, *Journal of Dynamic Systems, Measurement and Control*, in press, Feb 2016

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.

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
- "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