January, 2023

CURRICULUM VITAE
DAVID ELATA

RESEARCH INTERESTS

Micro-Electro-Mechanical Systems (MEMS): modeling, design, fabrication and characterization of devices; electrostatic, thermoelastic, piezoelectric and electromagnetic actuation; design of novel micromirrors, switches, resonators and oscillators; investigation of mechanical properties of microstructures; micromachining.

PUBLIC PROFESSIONAL ACTIVITIES

Conference Organizing Committees

1. Co-Chair, Track 1 - Sensor Phenomenon, Modeling, and Evaluation, *IEEE Sensors 2017*, Oct 30-Nov 1, 2017, Glasgow, Scotland, UK.
2. Co-Chair, Track 1 - Sensor Phenomenon, Modeling, and Evaluation, *IEEE Sensors 2016*, Oct 30-Nov 2, 2016, Orlando, FL, USA.
3. Co-Chair, Track 5 - Mechanical, Magnetic, and Physical Sensors, *IEEE Sensors 2013*, November 3-6, 2013, Baltimore, MD, USA.

Conference Technical Program Committees

4. *IEEE MEMS 2021*, January 24-28, 2021, Virtual meeting, Earth.
5. *IEEE SENSORS 2020*, October 25-28, 2020, Rotterdam, The Netherlands.
6. *IEEE MEMS 2020*, January 18-22, 2020, Vancouver, Canada.
7. *Eurosensors 2018*, September 9-12, 2018, Graz, Austria.
8. *Eurosensors 2017*, September 3-6, 2017, Paris, France.
9. *IEEE Transducers 2017*, June 18-22, 2017, Kaohsiung, Taiwan.
10. *Eurosensors 2016*, September 4 - 7, 2016, Budapest, Hungary.
11. *IEEE Transducers 2015*, June 21-25, 2015, Anchorage, Alaska, USA. *Member of the Executive Program Sub Committee (EPSC).*
12. *IEEE Sensors 2014*, November 2-5, 2014, Valencia, Spain.
13. *Eurosensors 2014*, September 7-10, 2014, Brescia, Italy.
14. *IEEE Transducers 2013*, June 16-20, 2013, Barcelona, Spain.
15. *IEEE Sensors 2012*, October 28-31, 2012, Taipei, Taiwan.
16. *Eurosensors 2012*, September 9-12, 2012, Krakow, Poland.
17. *IEEE Sensors 2011*, October 28-31, 2011, Limerick, Ireland.
18. *IEEE Transducers 2011*, June 5-9, 2011, Beijing, China.
19. *Eurosensors 2011*, September 4 - 7, 2010, Athens, Greece.
20. *IEEE Sensors 2010*, November 1-4, 2010, Hawaii, USA.
21. *Eurosensors 2010*, September 5 - 8, 2010, Linz, Austria.
22. *Eurosensors 2009*, September 6-9, 2009, Lausanne, Switzerland.
23. *IEEE Transduc*ers *2009*, June 21 - 25, 2009, Denver.
24. *EuroSimE 2009*, April 27-29, 2009, Delft, the Netherlands.
25. *IEEE MEMS 2009*, January 25-29, 2009, Sorrento, Italy.

26. *Eurosensors 2008*, September 7-10, 2008, Dresden, Germany.
27. Track Leader, Micro and Nano Technology, *ASME-ES*DA 2008, July 9-7, 2008, Haifa Israel.
28. *EuroSimE 2008*, April 21-23, 2008, Freiburg, Germany.
29. *IEEE MEMS 2008*, January 13-17, 2008, Tucson, Arizona, USA.
30. *European Nano Systems 2007 EMN07*, 3-4 December 2007, Paris.
31. *IEEE NANO 2007*, August 2-5, 2007, Hong Kong SAR, China.
32. *EuroSimE 2007*, 16-18 April 2007, London.
33. *European Nano Systems 2006 EMN06*, 14-15 December 2006, Paris.
34. *European Nano Systems 2005 EMN05*, 14-16 December 2005, Paris.
35. Co-Organizer of a workshop on "Design and Modelling Methods for RF MEMS", in *Design, Testing, Integration and Packaging of MEMS/MOEMS - DTIP 2005* Conference, 31 May - 03 June 2005, Montreux, Switzerland.
36. *European Micro and Nano Systems 2004 EMN04*, 20-21 October 2004, Noisy le Grand, Paris.

GRADUATE STUDENTS
(Primary Supervisor unless stated otherwise)

Ph.D. Students

Completed (9)

PhD1. Ronen Eshkenazy, July 2004, "Fatigue of steel wire ropes", Primary supervisor Menachem Weiss. Founder and owner of *Matron Rope & Wire Rope Engineering ltd*.

PhD2. Samy Abu-Salih, August 2006, "Modeling and Analysis of Electromechanical Buckling with Application to Novel MEMS Devices".

PhD3. Rashed Mahameed, August 2006, "Thermal effects in micro-systems, and application in novel micro-devices".

PhD4. Saar Golan, Ph.D., August 2007, "Differentiation of multi species biofluids by dielectrophoretic field flow fractionation". Primary supervisor Uri Dinar.

PhD5. Vitaly Leus, July 2009, "New efficient methods for modeling, design and actuation of electrostatic micro mechanical devices".

PhD6. Arnon Hirshberg, February 2013, "Mechanical coupling in deformable structures in micro-systems".

PhD7. Shai Shmulevich, February 2016, "Measures of the response of electromechanical resonators".

PhD8. Inbar Hotzen, January 2017, "Selective stiffeners for improving the performance of MEMS structures".

PhD9. Adne Kassie, April 2022, "investigation of the response of resonators and parametric resonators".

In progress (1)

PhD10. David Rosenstock, commenced July 2022, "The dynamics response of vibrating disks and rings that are made from anisotropic material and are fixed to a rotating frame".

M.Sc. Students:

Completed (30)

MS1. Saar Golan, December 2002, "The relationship between the anatomy of the Canaliculi, the pressure at its ends and the blood flow through it". Primary supervisor Uri Dinar.

MS2. Rashed Mahameed, June 2003, "A novel thermoelastic actuation scheme for micro resonators", ***Cum laude***.

MS3. Dani Strasser, December 2003, "Binding layers for delaying damage in electronic boards".

MS4. Eyal Elka, February 2004, "Attenuation of vibration levels in sandwich structure by piezoelectric layers", ***Summa cum laude***. Primary supervisor David Elata additional supervisor Haim Abramovich.

MS5. Matan Naftali, June 2004, "Electrostatic actuation schemes for MEMS devices".

MS6. Arnon Hirshberg, November 2004, "Novel test devices for measuring mechanical properties of MEMS structures".

MS7. Ofir Barzely, June 2005, "Double sided comb drive with latching stators to minimize actuation voltages".

MS8. Vitaly Leus, December 2005, "Modeling the static and dynamic responses of electrostatic MEMS switches".

MS9. Shay Yulzary, January 2008, "Electromechanical instabilities in MEMS".

MS10. Eran Ben-David, July 2008, "Nano mechanical tensile test device". Primary supervisor Dani Ritel, additional supervisors David Elata and Doron Shilo.

MS11. Michael Lerman, March 2011, "The quality of quality-factor in micro resonators".

MS12. Ben Rivlin, **Brakim**, March 2012, "Non-linear springs for achieving prescribed electromechanical transduction".

MS13. Alon Benhaim, **Brakim**, July 2012, "Self alignment using electromagnetic induction for mass fabrication of micro-coils".

MS14. Shai Shmulevich, "Measures of the response of electromechanical resonators". October 2012.

MS15. Inbar Hotzen, March 2013, "MEMS resonators".

MS16. Osher Shapira, **Brakim**, August 2013, "Electromagnetic actuation in MEMS".

MS17. Tal Rubin, **Brakim**, July 2014, "The electromechanical response of dielectric materials".

MS18. Daniel Ekeltchik, **Brakim**, October 2015, "MEMS devices for measuring strength of microbeams".

MS19. Ido Zaltzman, **Brakim**, December 2015, "Electromechanical Franklin oscillators".

MS20. Aharon Joffe, **Brakim**, July 2016, "Electromechanical Parametric Resonators".

MS21. Adne Kassie, commenced October 2015, "Thermally compensated folded-beam suspension", transferred to a direct Ph.D. program July 2016.

MS22. Nadav Maccabi, **Brakim**, July 2017, "Enhancing the functionality of unimorph

piezoelectric actuators".

MS23. Eli Benvenisty, **Brakim**, August 2019, "Vibration mode order in mechanical disk resonators".

MS24. Sahar Lustig, **Brakim**, January 2020, "Piezoelectric Actuators and Vibrating Energy Harvesters ".

MS25. Shir Benita, **Brakim**, January 2021, "Single-crystalline piezoelectric linear actuators".

MS26. Sivan Levi, July 2021, "Wineglass mode resonators with optimized geometry for mode matching and mode ordering".

MS27. Julian Levinton, January 2022, "Single crystalline piezoelectric actuators".

MS28. Eyal Ben-Yosef, May 2022, "Piezoelectric actuators".

MS29. David Rosenstock, May 2022, "The nonlinear dynamics of vibrating rings".

MS30. Lior Musnikov, commenced October 2020, "The nonlinear dynamics of vibrating beams".

MS31. Assaf Menashe, December 2022, "Coriolis vibratory gyroscopes operated by auto-resonance driving ".

MS32. Itamar Shoham, commenced October 2021, "Surface waves in single-crystalline piezoelectric actuators".

RESEARCH GRANTS (If there are co-PIs they are explicitly listed)

2022-26 Israel Science Foundation (ISF), **₪1,118,000** for four years, "Electrostatic parametric resonators with electrostatically floating rotors".

2022-23 RAFAEL, **₪200,000**, "Failure mechanisms in microsystems".

2019-21 Israel Ministry of Science and Technology, Applied Engineering Research, **₪600,000** for three years, "High functionality piezoelectric actuators".

2019 MAFAAT, **₪254,014** for three years, "Single-Crystalline Piezoelectric Devices for Micromirror Applications and Energy Harvesting".

2016-20 Israel Science Foundation (ISF), **₪1,080,000** for four years, "Experimental investigation of parametric resonators".

2014-16 MAFAAT, **₪212,000**, "Measuring strength of microbeams".

2013-16 Israel Strategic Alternative Energy Foundation (I-SAEF), **$200,000**, "Mechanical Batteries".

2012-13 MAFAAT, **₪170,000**, "Measuring strength of microbeams".

PUBLICATIONS

Refereed papers in professional journals (student names underlined)

J1 D. Elata, "On the static and dynamic response of electrostatic actuators", *Micro and Nano-scale Mechanics, Special Issue of the Bulletin of the Polish Academy of Sciences*, **53**(4), 373-384, 2005.

J2 D. Elata, G. Ben-Dor and O. Igra, "The effect of distributions of particle

nonuniformities on the flow field behind steady normal shock waves", *Int. J. of Heat and Fluid Flow*, **10**(2), 152-159, 1989.

J3 P. Bar-Yoseph and D. Elata, "An efficient L2 Galerkin finite element method for multi-dimensional nonlinear hyperbolic systems", *Int. J. Num. Meth. Eng.*, **29**(6), 1229-1245, 1990.

J4 P. Bar-Yoseph, D. Elata and M. Israeli, "On the generalized L2 Galerkin finite element method for linear hyperbolic equations", *Int. J. Num. Meth. Eng.*, **36**(4), 679-694, 1993.

J5 D. Elata and M.B. Rubin, "Isotropy of strain energy functions which depend only on a finite number of directional strain measures", *ASME J. of Applied Mechanics*, **61**(2), 284-289, 1994.

J6 D. Elata and M.B. Rubin, "A new representation for the strain energy of anisotropic elastic materials with application to damage evolution in brittle materials", *Mechanics of Materials*, **19**(2), 171-192, 1995.

J7 M.B. Rubin, D. Elata and A.V. Attia, "Modeling added compressibility of porosity and the thermomechanical response of wet porous rock with application to Mt. Helen tuff", *Int. J. of Solids and Structures*, **33**(6), 761-793, 1996.

J8 D. Elata and J. Dvorkin, "Pressure sensitivity of cemented granular materials", *Mechanics of Materials*, **23**(2), 147-154, 1996.

J9 D. Elata, "On the oblique compression of two elastic spheres", *ASME J. of Applied Mechanics*, **63**(4), 1039-1041, 1996.

J10 D. Elata and J.G. Berryman, "Contact force-displacement laws and the mechanical behavior of random packs of identical spheres", *Mechanics of Materials*, **24**(3), 229-240, 1996.

J11 D.L. Johnson, L.M. Schwartz, D. Elata, J.G. Berryman, B. Hornby and A.N. Norris, "Linear and nonlinear elasticity of granular media: Stress-induced anisotropy of a random sphere pack", *ASME J. of Applied Mechanics*, **65**(2), 380-388, 1998.

J12 D. Elata, "Pure volumetric compaction of a prestressed nonlinear hyperelastic solid with reference to poroelastic materials", *Mechanics of Materials*, **31**(2), 141-147, 1999.

J13 D. Elata, "On the problem of rigid inclusions between two dissimilar elastic half-spaces with smooth surfaces", *Int. J. of Solids and Structures*, **36**(17), 2633-2636, 1999.

J14 D. Elata and I. Garaway, "A creative introduction to mechanical engineering", *Int. J. of Eng. Education*, **18**(5), 566-575, 2002.

J15 O. Bochobza-Degani, D. Elata and Y. Nemirovsky, "An efficient DIPIE algorithm for CAD of electrostatically actuated MEMS devices", *IEEE JMEMS*, **11**(5), 612-620, 2002.

J16 O. Bochobza-Degani, D. Elata and Y. Nemirovsky, "A general relation between the ranges of stability of electrostatic actuators under charge or voltage control", *Appl. Phys. Lett.*, **82**(2), 302-304, 2003.

J17 O. Bochobza-Degani, D. Elata and Y. Nemirovsky, "Micromirror device with reversibly adjustable properties", *IEEE/ Photonic Tech. Lett.*, **15**(5), 733-735, 2003.

J18 M. Frank, I. Lavy, and D. Elata, "Implementing the project-based learning approach in an academic engineering course", *Int. J. of Tech. and Design Education*, **13**(3), 273-288, 2003.

J19 D. Elata, O. Bochobza-Degani and Y. Nemirovsky, "Analytical approach and numerical α-lines method for pull-in hyper-surface extraction of electrostatic actuators with multiple uncoupled voltage sources", *IEEE JMEMS*, **12**(5), 681-691, 2003.

J20 D. Elata, R. Eshkenazy and M.P. Weiss, "The mechanical behavior of a wire rope with an independent wire rope core", *Int. J. of Solids and Structures*, **41**, 1157-1172, 2004.

J21 E. Elka, D. Elata and H. Abramovich, "The electromechanical response of multilayered piezoelectric structures", *IEEE JMEMS*, **13**(2), 332- 341, 2004.

J22 R. Eshkenazy, D. Elata and M.P. Weiss, "Analysing the mechanical behavior of a non-rotating wire rope", *J. Mech. Behav. Materials*, **14**(6), 383-396, 2004.

J23 M. Frank and D. Elata, "Developing the capacity for engineering systems thinking (CEST) of freshman engineering students". *Systems Engineering*, **8**(2), 187-195, 2005.

J24 D. Elata and S. Abu-Salih, "Analysis of a novel method for measuring residual stress in micro-systems". *J. Micromech. Microeng.*, **15**(5), 921-927, 2005.

J25 S. Abu-Salih and D. Elata, "Analytic postbuckling solution of a pre-stressed infinite beam bonded to a linear elastic foundation ". *Int. J. of Solids and Structures*, **42**(23), 6048-6058, 2005.

J26 D. Elata and V. Leus, "How slender can comb-drive fingers be?". *J. Micromech. Microeng.*, **15**(5), 1055-1059, 2005.

J27 R. Mahameed and D. Elata, "Two-dimensional analysis of temperature-gradient actuation of cantilever beam resonators". *J. Micromech. Microeng.*, **15**(8), 1414-1424, 2005.

J28 D. Elata and H. Bamberger, "On the dynamic pull-in of electrostatic actuators with multiple degrees of freedom and multiple voltage sources", *IEEE JMEMS*, **15**(1), 131-140, 2006.

J29 D. Elata and A. Hirshberg, "A novel method for measuring the strength of microbeams". *IEEE JMEMS*, **15**(2), 396-405, 2006.

J30 D. Elata and S. Abu-Salih, "Analysis of electromechanical buckling of a prestressed microbeam that is bonded to an elastic foundation". *Journal of Mechanics of Materials and Structures*, **1**(5), 911-923, 2006.

J31 S. Abu-Salih and D. Elata, "Experimental validation of electromechanical buckling". *IEEE JMEMS*, **15**(6), 1656-1662, 2006.

J32 S. Golan, D. Elata, M. Orenstein and U, Dinnar "Floating electrode dielectrophoresis", *Electrophoresis* ,**27**(24), 4919-4926, 2006.

J33 S. Golan, D. Elata and U, Dinnar, "Hybrid dielectrophoresis devices that employ electrically floating electrodes", *Sensors and Actuators A*, **142**(1), 138-146, 2008.

J34 V. Leus and D. Elata, "On the dynamic response of electrostatic MEMS switches" *IEEE JMEMS*, **17**(1), 236 - 243, 2008.

J35 R. Mahameed and D. Elata, "Shield-layers for reducing thermoelastic damping in resonating Silicon bars". *J. Microsystem Technologies*, **15**(2), 323-331, 2008.

J36 G. Bahl, R. Melamud, B. Kim, S.A. Chandorkar, J.C. Salvia, M.A. Hopcroft, D. Elata, R.G. Hennessy, R.N. Candler, R.T. Howe and T.W. Kenny, "Model and Observations of Dielectric Charge in Thermally Oxidized Silicon Resonators". *IEEE JMEMS*, **19**(1),162-174, 2010.

J37 M. Ziaei-Moayyed, D. Elata, E. Quevy and R.T. Howe, "Differential internal dielectric transduction of a Lamé-mode resonator", *J. Micromech. Microeng.*, **20**(11), 115036 (15 pages), 2010.

J38 D. Elata, V. Leus, J. Provine, A. Hirshberg and R. T. Howe, "Electromechanical sensing of charge retention on floating electrodes", *IEEE JMEMS*, **20**(1), 150-156, 2011.

J39 D. Elata, "The Electromechanical response of a symmetric electret parallel-plates actuator", *Sensors and Actuators A*, **173**(1), 197-201, 2012.

J40 B. Rivlin and D. Elata, "Design of nonlinear springs for attaining a linear response in gap-closing electrostatic actuators", *Int. J. Solids and Structures*, **49**(26), 3816-3822, 2012.

J41 S. Shmulevich, M. Lerman and D. Elata, "On the quality of quality-factor in gap-closing electrostatic resonators", *Journal of Micromechanics and Microengineering*, **23**(11), 115010 (10 pages), 2013.

J42 S. Shmulevich, B. Rivlin, I. Hotzen and David Elata, "A gap-closing electrostatic actuator with a linear extended dynamic range", *IEEE JMEMS*, **22**(5), 1109-1114, 2013.

J43 S. Shmulevich, A. Joffe, I. (Hotzen) Grinberg and D. Elata, "On the notion of a mechanical battery". *IEEE-JMEMS*, **24**(4), 1085-1091, 2015.

J44 S. Shmulevich, I. Hotzen and D. Elata, "A MEMS implementation of a classic parametric resonator", *IEEE-JMEMS*, **24**(5), 1285-1292, 2015.

J45 S. Shmulevich and D. Elata, "Dynamically-balanced folded-beam suspensions for resonators", *IEEE-JMEMS*, **24**(6), 1965-1972, 2015.

J46 A. Benhaim, O. Shapira and D. Elata, "Electromagnetic interaction force between two noncoaxial circular coils", *Mechatronics*, **30**, 244-253, 2015.

J47 I. (Hotzen) Grinberg, O. Ternyak, S. Shmulevich and D. Elata, "Selective stiffening for producing a mass-fabrication compatible motion conversion mechanism", *IEEE-JMEMS*, **24**(6), 2101-2108, 2015.

J48 I. (Hotzen) Grinberg, S. Shmulevich and D. Elata, "Selective stiffening for enhancing and/or reversing the action of thermoelastic actuators". *IEEE-JMEMS*, **25**(6), 999-1004, 2016.

J49 S. Shmulevich and D. Elata, "A MEMS implementation of the classic Meissner parametric resonator: exploring high-order windows of unbounded response". *IEEE-JMEMS*, **26**(2), 325-332, 2017.

J50 I. (Hotzen) Grinberg, N. Maccabi, A. Kassie, D. Elata, "A piezoelectric twisting beam actuator". *IEEE-JMEMS*, **26**(6), 1279-1286, 2017.

J51 E. Benvenisty and D. Elata, “Frequency matching of orthogonal wineglass modes in disk and ring resonators made from (100) silicon”. *IEEE SENSORS Letters*, **3**(3), 1-4, 2019.

J52 S. Lustig and D. Elata, "Ambiguous definitions of the piezoelectric coupling factor". *Journal of Intelligent Material Systems and Structures*, **31**(14), 1689–1696, 2020.

J53 S. Levi, D. A. Kassie and D. Elata, "The static response of a beam that is guided along two non-parallel walls". *Mechanics Research Communications*, **107** 103552, 2020.

J54 D. A. Kassie, S. Levi and D. Elata, "A double-sided comb-drive actuator with a floating rotor: Achieving a strong response while eliminating the dc bias". *IEEE-JMEMS*, **29**(5),

1173–1179, 2020.

J55 D. A. Kassie and D. Elata, "The effect of laser light on the response of electrostatic silicon resonators". *IEEE Sensors Journal*, **21**(1), 412-420, 2021.

J56 D. A. Kassie and D. Elata, "Parametric resonators with a floating rotor: sensing strategy for devices with an increased stiffness and compact design". *IEEE-JMEMS*, **30**(3), 411–418, 2021.

J57 D. A. Kassie and D. Elata, "Harmonic biasing in a double-sided comb-drive resonator, for resolving feed-through issues in low-power driving". *Sensors and Actuators A Physical*, **332**(1), 113031, 2021.