

Shahar Ben-Menahem, Ph.D.

Math- and Physics-based Modeling and Algorithm Development

phone: (cell) (650)740-1392
e-mail: thermosalamis@gmail.com

I am a theoretical physicist, applied mathematician and engineer, with extensive experience applying modeling and algorithm-development skills to a variety of engineering challenges involving both hardware and software. I hold citizenships in both the U.S. and Israel.

Projects, Employment and Academics:

- (1) **2013 to present:** Contract (2.5 years) *and* FTE (5 years) *work for two groups within* Microsoft, *at their Silicon Valley Campus (MS-SVC):*

June 2015 to Present (HoloLens Launch Team): Worked on a range of analog hardware technology projects involving material science, mechanical engineering, IR and VIS optics, EMI, RF sensing, LIDAR, Human Factors (comfort), motion capture, metrology and thermal management. My work included modeling and simulations, design of experiments, and evaluating emerging technologies. In my projects, I leverage wide-ranging expertise in mathematical modeling, optimization and algorithmics, as well as classical and quantum physics.

Led the creation, implementation and empirical validation of a multiscale, rapid & agile diagnostics, modeling and simulation architecture (the latter utilizing COMSOL, MATLAB as well as LUTs and co-simulation codes) for heat pipes and vapor chambers, both standalone and embedded within devices (for thermal management purposes).

Nov 2013 through May 2015: Worked on the Xbox camera (Kinect). Made significant contributions to several projects involving Time Of Flight (TOF) depth camera modeling, calibration and operation, including: advanced multi-parameter optimization algorithms; predictive models of CMOS-APS (Active Pixel Sensor) scene-depth noise and multi-device interference; and image processing/machine vision algorithms for calibration and operation of TOF cameras. My model-based algorithms for these projects have been coded in MATLAB. Some of this work also involved interfacing with firmware.

- (2) **2013:** Avionic GPS algorithms: pseudocode and simulations, using a Kalman filter, for real-time analysis of GPS data and subsequent broadcast of FAA-required Receiver Autonomous Integrity Monitoring metrics (GPS-RAIM) from GA (General Aviation) aircraft.
- (3) **2009 thru 2013:** *Combination of contract and employee work and academic research; contract work done both as individual, and as part of Modoc Analytics LLC (which I co-founded in 2010).*

- **2013:** Key role in proposing, winning and carrying out R&D work for a **NASA grant** (CIF 2013) for developing a prototype efficient, diffractive photovoltaic wrap for small satellites.
- **2012:** A small company I co-founded, *Modoc Analytics*, won a **California grant** (Cal PIER) for automated electro-optical monitoring (system identification) of photovoltaic arrays to detect performance degradations.
- **2007-2013:** Developed algorithms for iPhone apps that combined DSP innovations in machine vision, computational geometry, Bayesian inference, and Joint Time-Frequency Analysis, as well as some biophysics modeling. The iPhone video imageries analyzed by my algorithms were chemical and biophysical in nature, and the apps involved monitoring the environment and automated biomedical diagnoses. (*For **Lightfar Cineonics, Ltd** of Canada*)
- **2012:** Optimal-control algorithms for automated aircraft trajectory planning with multi-waypoint flight plans (*under a **NASA grant***)
- **2010-2013:** Developed realistic, fast-running, integrated optical-thermal-electric models for photovoltaic (PV) arrays (flat-panel or CPV), and associated data-driven automated diagnostics algorithms, to monitor array health and detect/attribute/mitigate hot spots. Data was taken in a grant-funded rooftop PV-array lab. Code written in C/C++ and MATLAB.
(*An academia-industry collaboration; funded by three federal **SBIR** and **STTR** grants, including a Phase II; **CMU/DOE/NSF***)
- **2009-2013:** Research, teaching and grant-funded work at **Carnegie Mellon University** — Silicon Valley campus (CMU-SV), including as **Adjunct Professor**.
- **2011:** Model-based DSP algorithms for detection and estimation of signals of interest in datasets with high noise and clutter levels (in particular, ***geoseismic exploration*** data).
(*for **Vialogy LLC**, of Pasadena, California*)
- **2011:** With my **Modoc Analytics LLC** partner, developed a MATLAB-based GUI software tool for design & optimization of high-concentration CPV plants.
(*as **Modoc Analytics LLC**, under contract with **Cool Earth Systems***)
- **2010:** Assisted *Nest Labs* in initial algorithm designs, sensor suite selection, patent submission, and engineering staff hiring, related to their ‘smart thermostat’ project in its early phase.
(*as **Modoc Analytics LLC**, under contract with **Nest Labs***)
- **2013:** Academic research on *diffractive non-imaging optics* for solar energy applications
(*partially funded by **NASA grant***)
- **2013:** **Modoc Analytics** R&D research and white-paper preparation on *Long Period Fiber Grating* (LPFG) *strain sensors*, including physics modeling and simulations of the plant and sensor-fusion algorithms.
- **2010-2013:** Academic research on the *stability and control of flexible-wing* aircraft.
- **2009:** Development of *adaptive control* schemes, algorithms and stability metrics for fixed-wing aircraft and helicopters, *inter alia* to guarantee automated flight safety recovery in case of unusual slung loads or catastrophic aircraft mechanical failures during flight.
(*funded by **DARPA** and **NASA**, **IRAC project***)

- (4) **1993 to 2009:** Combination of academic appointments and positions as employee in industry.
- a. *Avago Technologies* RF modeling; optimization and design of layered, multi-
2007-2009: piezoelectric-resonator BAW filters for mobile phones, including
3D models and study of nonlinear effects (harmonics,
Inter-modulations)

- b. *Vialogy LLC* Senior Scientist. Development of model-based algorithms
2005-2007: for denoising extremely low-SNR datasets. Work on mass-
spectrometry data led to conference presentation and a patent.
Later (2011) I applied similar techniques to geoseismic
exploration data.
- c. *Tymphany Corp* Electromagnetic, electromechanical and acoustic modeling of
2002-2003: various types of audio speakers, and development of speaker-cone
position detection methods and firmware-implemented feedback
linearization control algorithms to make cheap speakers sound better.
- d. *C-Cor Electronics* Senior Staff Scientist. R & D leadership roles in DWDM Optical
2000-2002: Fiber Communications, from device physics and component level
(EDFAs, Raman amplifiers, EA modulation, DFB laser chips,
passive components etc.) to entire networks.
- e. *DULY Research*
& Stanford Linear
Accelerator Center
(SLAC) Grant-funded R & D in accelerator physics and engineering,
1993-1999: in collaboration with other national labs and private companies.
Modeling, simulation, design, optimization and testing of high
-power RF sources, electron guns, klystrons, RF couplers, accelerating
structures, and related X- , gamma-ray and positron sources
utilizing collision of multi-GeV electron beams with multi-
TeraWatt, sub-picosecond laser pulses.
- f. *Stanford University*
Dept. of Physics
1993-2008: Visiting Scientist.

(5) 1985 to 1992: Academic appointments and affiliations

(postdoctoral research & teaching positions) at: Weizmann Institute, Boston University, Tel Aviv University, Harvard, SLAC (Stanford), Rutgers University, and City College of New York.

(6) 1983 to 1986: Military Service (Israel Defense Forces, IAF)

(7) 1983: Ph.D., Stanford University (Physics)

***Publications, patents, proposals
and reports:***

Authored and co-authored scores of scientific publications (journal-published and conference papers); wrote and co-wrote numerous SBIR (Small Business Innovation Research), STTR and other grant proposals and reports, and many white papers. Listed as inventor or co-inventor of many patents.

List of publications and patents available upon request.

Nationality:

I am a citizen of both Israel and the U.S.