PIERRE MALDAGUE

Scientist and Software Architect

BACKGROUND

Educated in Belgium, I wanted to really understand quantum mechanics in depth. I obtained a PhD from MIT and conducted research at IBM and Brandeis, which resulted in a dozen papers in physics journals. This activity quenched my thirst for insight, but it also made me aware of the need to find applications of basic research to real problems.

A job offer prompted me to move to Michigan, where I led several teams to pioneer the use of CAD/CAM and robotic vision in car manufacturing. Initially I worked for Ford, but I caught the entrepreneurial bug and signed up with a short succession of start-ups as a technical guru in charge of advanced applications. This was a very exciting time.

But the action was in California. I moved there as a hi-tech consultant and decided to focus on my strengths. A sharp programmer and architect with a deep understanding of physics, I also enjoy excellent communications skills. In addition to my work at JPL, I have stayed very active on my own time, both as a paid consultant and as a researcher in mathematical physics.

EDUCATION

1975 **PhD, Theoretical Physics**
MIT

1971 **MS Electrical Engineering**
University of Louvain, Belgium

GOAL

I want to join a team that is as determined as I am to achieve technical excellence using the best information technology available.

SOFTWARE

- C++ (primarily)
- Java
- Linux
- Mac
- Windows
- Solaris
- Protégé
- MagicDraw SysML
- MagicDraw UML
- Latex

CONTACT

Pierre F. Maldague
533 S. Hudson ave., Apt. 2, Pasadena, CA 91101
siegelfan@gmail.com (323) 646-2020

EXPERIENCE

1993–2021	**Architect, S/C simulation software** NASA/JPL, Pasadena, CA	Implemented and led the deployment of planning software for Cassini, MER, Deep Impact, Phoenix, InSight and Europa Clipper missions. The system integrates multiple models of spacecraft behavior and has demonstrated performance up to 10,000 times real-time. It provides a Domain-Specific Language (DSL) for linking models to activities and for scheduling these activities subject to constraints.
1985-1992	**CAD/CAM & Visualization Consultant** Geosphere Project, CA Harper Hospital, MI 3Name-3D, CA JPL, Pasadena, CA Teknekron Corp., Berkeley Applicon, Ann Arbor, MI ESI Inc., Dearborn, MI	Developed integrated tools for processing satellite data into accurate, yet aesthetically pleasing images of the Earth. Used mathematical morphology to automate the task of programming machine tools to cut complex shapes. Hired programmers to develop advanced CAD/CAM software which improved productivity 30%. Established collaborative partnerships between industry and JPL with financing from the State of California. Helped a game manufacturer with the physics of baseball.
1979-1984	**Research Staff** Ford Motor Co., Dearborn, MI	Pioneered the use of CAD/CAM in the design of cylinder heads. Developed a theory of laminar flames that explained experiment.
1978-1979	**Assistant Professor of Physics** Brandeis University, Waltham, MA	Taught numerical analysis and thermodynamics. Published a paper on a new approach to positron annihilation in metals.
1975-1977	**Post-Doctoral Research Associate** IBM Research, Yorktown Heights, NY Purdue University, W. Lafayette, IN	Derived transport theory in metals from first-principles kinetic equations using many-body perturbation techniques and Feynman diagrams. Published the results in the physics literature.

PUBLICATIONS

Physics

Electron-Hole scattering and the Electrical Resistivity of the Semimetal TiS2, Phys. Rev. Letters **37**, 782 (1976) (with C. A. Kukkonen)

The electrical resistivity of bismuth: electron-hole scattering, J. Phys. F **6**, L301 (1976) (with C. A. Kukkonen)

Theory of infrared absorption in tetrathiofulvalene-tetracyanoquinodimethane (TTF-TCNQ), IBM Research Report **RC9633** (1977)

Optical Spectrum of a Hubbard Chain, Phys. Rev. **B16**, 2437 (1977)

Effect of Incipient Charge Density Waves on Second-Order Raman Spectroscopy, Proc. Int. Conf. on Layered Materials, Paris (1978)

Effect of Exchange on Charge Density Waves in Layered Compounds, Solid State Commun. **26**, 133 (1978)

Many-body corrections to the polarizability of the two-dimensional electron gas, Surf. Sci. **73**, 296 (1978)

Gate Electrode using Localization Effects, IBM Technical Disclosure Bull. **21**, 1268 (1978)

Electron-electron scattering, Hall coefficient and magnetoresistance, Phys. Rev. **B19**, 2394 (1979) (with C. A. Kukkonen)

Microscopic calculation of the nonlinear current fluctuations of a metallic resistor: The problem of heating in perturbation theory, Phys. Rev. **A19**, 1721 (1979) (with A.-M. Tremblay, B. Patton and P. C. Martin)

Electron-electron scattering and the resistivity of metals, Phys. Rev. **B19**, 6172 (1979) (with C. A. Kukkonen)

Positrons in metals: A real-space approach, Phys. Rev. **B20**, 21 (1979)

A variational approach to the ground state of the two-dimensional electron gas, Physica **99B**, 250 (1980) (with D. M. Nicholson)

Quantum diffusion and divergent fluctuations in disordered metals, Phys. Rev. **B23**, 1719 (1981)

Size effects and low-temperature conductivity anomalies in metallic conductors, Canadian J. Physics **60**, 718 (1982)

Space Exploration

MAPGEN: Mixed-Initiative Planning and Scheduling for the Mars Exploration Rover Mission, IEEE Intelligent Systems, available online as http://ti.arc.nasa.gov/m/pub-archive/542h/0542%20(Ai-Chang)%20v3.pdf (with M. Ai-Chang, J. Bresina, L. Charest, A. Chase, J. Cheng-jung Hsu, Ari Jonsson, R. Kanefsky, P. Morris, K. Rajan, J. Yglesias, B. Chafin and W. Dias) (2004)

Deep Impact Sequence Planning Using Multi-Mission Adaptable Planning Tools With Integrated Spacecraft Models, AIAA Proc. 2006 Space Operations Conference (with S. Wissler, J. Rocca and C. Seybold)

The Evolvable Advanced Multi-Mission Operations System (AMMOS): Making Systems Interoperable, AIAA Proc. 2010 Space Operations Conference (with A. Ko, T. Bui, D. Lam and J. McKinney)

Towards a Cradle-to-Grave, Mission-Wide Simulation System, AIAA Proc. 2018 Space Operations Conference (with S. Wissler)

$$\int_a^b f(x)\,dx = F(b) - F(a)$$

Mathematics

Diagonalization of self-adjoint extensions of the Bessel operator of imaginary index using elliptic functions, preprint (2008)

Translation of Carl Siegel's 1939 paper "Einheiten quadratischer Formen" (Units of Quadratic Forms), preprint (2010)

TESTIMONIALS AND AWARDS

"His technical expertise as well as his constant good cheer makes him **a pleasure to work with**."

Stuart Stevens, Dawn Mission Planning Lead (2006)

"**The system he put together performed admirably** in testing and has become a critical component of Phoenix science planning. In our most recent Operations Readiness Tests, the science team was able to accurately predict which products would downlink during which pass - a capability enabled by Pierre's work."

Miles Smith, Phoenix Science System Engineer (2008)

"Pierre's knowledge of APGEN has been **extremely valuable** in furthering the EPOXI projects efforts to **minimize risk** to the spacecraft, while **maintaining a high science return** while also **reducing the cost** of operations"

Steve Wissler, EPOXI Spacecraft Team Chief (2009)

"Pierre has **strong technical skills in both software and the underlying physics**, a **rare combination** that is necessary to be a good architect for the ISCA task "

Yu-Wen Tung, ISCA Task Manager (2010)

Certificate of Appreciation (April 1997)

"Awarded to Pierre F. Maldague for his **relentless pursuit of quality**, **error free software** in the development of the Mission Ground Systems Office multi-mission uplink software tools SEQ_REVIEW and APGEN"

Award for Excellence (September 2006)

"For **outstanding accomplishment in refactoring** APGEN into a modular architecture"

NASA Certificate of Recognition (August 2008)

"For the **creative development of a technological contribution** which has been determined to be of significant value in the advancement of the space and aeronautical activities of NASA and is entitled *Persistent Application Planning Server*"

SOFTWARE APPLICATIONS

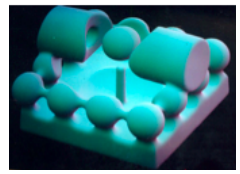
Software to which I contributed 50% or more of the code

HEAD

In the early days of CAD/CAM, one of the main problems was to hook up analytical models to the computer hosting the CAD/CAM software.

My colleagues and I at Ford Motor Company figured out how to combine mathematical models of complex shapes such as solid models of direct-injection Diesel engine intake ports with the surface and display capabilities of state-of-the-art CAD systems.

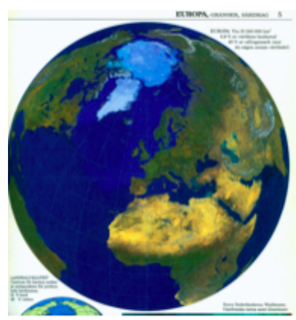
HAUS



A 3-D solid modeler based on the Hausdorff distance function. The motivation for HAUS was the need to compute machining toolpaths in a global way, as opposed to the local, differential methods used in the past. Using Hausdorff functions as the fundamental representation of solid objects made it very easy to compute offsets as required for toolpath calculations, so that one could easily program a 3-axis machine tool to cut a 3-D model of arbitrary complexity.

Geomap

A software application that could extract data from NASA satellite archive and turn them into appealing pictures of the Earth, using color mapping and filtering techniques borrowed from image processing technology. The program could accommodate any standard projection such as Mercator and the spherical projection shown here. The picture shown at right was generated by Geomap; it is taken from an Atlas published by the Swedish company Bra Böcker, which was a client of the Geosphere Project where I was employed as a consultant.



APGen

APGen is an activity planning tool based on the discrete event simulation paradigm. It does not automate the task of coming up with optimized plans, a problem that has occupied the academic community for many years. Instead, APGen uses commonsense algorithms to come up with schedules that satisfy simple criteria. In addition, APGen can be linked to sophisticated external models of spacecraft behavior. APGen has been used in a number of NASA missions, including Cassini, Mars Exploration Rover (MER), MRO, Deep Impact, Phoenix, InSight and Europa.