603 Seagaze Dr #902
Oceanside, CA 92054

512/348-8065
kat@ekapadi.com

Computational Modeling Specialist **Scientific-software Developer** **Optical Physicist**

Computational physicist and computer scientist focused on developing practical computational models of complex systems, building on over 20 years of private-industry and university experience with **Computational Modeling**, **Robotics**, and **Lasers and Imaging Systems**.

COMPUTER SKILL AREAS

Languages (main ones): C++ (over 20 years experience), C, Python (10 years experience); modern functional languages including OCaml, Haskell, and Clojure-Lisp; X86, ARM and PIC assembly.
For a selection of code samples, please see: https://github.com/ekapadi/dragonfly.

API: MPI, OpenMP, POSIX, NumPy, Trilinos, LAPACK, CUDA.

OS: Linux (over 10 years experience: both SysV and BSD-style distributions), Windows.

Image Analysis: LTILib, OpenCV, Matlab, LabVIEW (external-module DLL interface).

Computational physics: T-matrix, DDA, Photon Monte Carlo, General Monte Carlo, Statistical particle-packing, Diffusive transport.

Embedded Programming: ARM CPU (M0 and M3), PIC CPU, Delta-Tau PMAC controllers.

Hardware development: ARM CPU (M0 and M3), PIC CPU, MEMs-sensor interface, Opto-electronics, Laser-system design, Design of specialty fiber-optic sensors.

CAD/CAM (and related): Custom robotics and CNC-system design including high-speed trajectory calculation and control under human-safety constraints, Real-time image analysis pipeline design, VariCAD, Blender, IGES and STEP file formats.

COMPUTATIONAL MODELING EXPERIENCE

- Developed a comprehensive multi-particle T-matrix-calculation software tool set allowing calculation with nanoparticle aggregates containing up to several thousands of particles, a tool set enabling efficient cluster-computer (MPI-based) computation of scattering cross-sections and of full internal electrodynamic fields. This tool set facilitates optimization of nanoparticle-based conjugates as contrast enhancement agents in biomedical cell and tissue imaging. (U. Texas, Biomedical Engineering)
- Developed single-particle T-matrix software tools for the calculation of the complete internal electrodynamic fields of optically-large asymmetric objects. These tools are unique in that they allow efficient, fully-scalable T-matrix calculations with completely adjustable numerical precision. (U. Leipzig, Soft Matter Physics)
- Analyzed the optical intensity fields, the associated mechanical stress, and the 3D temperature profile in the dual-beam laser trap. (U. Leipzig, Soft Matter Physics)
- Engineered a continuous-flow manufacturing process for the production of high-quality nanoparticle ceramic pre-cursor material utilizing low-cost thermal-energy sources. (Ksana)
- Provided computational simulations supporting and complementing the experimental work of the Bio-optical Nanodiagnostics group, including electrodynamic, photo-thermal, and diffusive-transport simulations. (U. Texas, Biomedical Engineering)
- Developed and evaluated physical models describing polarized reflectance from open-ocean fish species, as relevant to camouflage adaptation in the polarized-light regime. (U. Texas, Integrative Biology)

ROBOTICS / HARDWARE-SOFTWARE INTERFACE EXPERIENCE

- Designed and developed a functional-style Fourier-algorithm BLAS API to allow accelerator resource (e.g. GPU or Xeon-Phi) utilization to be configured transparently with respect to the details of the algorithm implementation. Using this API, the CPU and GPU-based implementations share code paths, and additional hardware accelerator modules may be added to the system without changing the overall structure of the code. (Clearbridge Biophotonics)
- Designed and developed a network-distributed multi-server, multi-process modular software system supporting the complete computational Fourier imaging instrument. This modular system allows multiple use-cases of the final imaging instrument to be conveniently implemented using high-level scripting languages, such as Javascript-based web development tools for the user-interface components, and embedded Python to interface to the primary imaging-system functionality. (Clearbridge Biophotonics)
- Developed and optimized an n-axis robotic-trajectory calculation and control program. This program was capable of generating machine-capability-constrained kinematic-trajectory information in real time, and it was used to safely control a 50-ton, 5-axis gantry robot employed in the fabrication of very-large-scale, 3D mold surfaces. (Janicki Machine Design)
- Completed consulting contracts for the design and construction of a fully autonomous underwater camera and instrumentation platform. This platform includes a software video / RPC interlink system allowing remote control of the high-end underwater cameras and instrumentation over ethernet using commodity Android devices. (Ekapadi)
- Developed and optimized a graphics device driver interfacing a new 3D-graphics core to the Microsoft Windows operating system. (Silicon Reality)
- Implemented high-speed pipeline software providing image analysis of video microscopy data in real time. (U. Leipzig, Soft Matter Physics)
- Designed and implemented a scripted software-control capability to allow accurate operation of the measurement and control system for days at a time without user intervention. (U. Texas, Thin-film Magnetics Lab)
- Designed and implemented electronic circuitry and the associated embedded software supporting multiple MEMs-based sensors on-board the underwater polarimetric imaging apparatus used by the group. (U. Texas, Integrative Biology)

LASERS AND IMAGING SYSTEMS EXPERIENCE

- Upgraded the mathematical consistency of several key steps in the Fourier image reconstruction algorithm used by the imaging system, thereby facilitating significant improvement in overall image-quality metrics such as image S/N and image resolution. (Clearbridge Biophotonics)
- Completed the design through manufacturing of a high-power, pulsed, dye-laser system for application to medical photo-thermolysis. (MBC)
- Designed innovative medical-imaging systems utilizing coherent light. The primary imaging technology we were developing has since become known as "Optical Coherence Tomography". (Laser Therapeutics)
- Proposed and directed the development of a ratio-metric fluorescent-dye-based system for real-time 3D thermal measurement in confocal microscopy. (U. Leipzig, Soft Matter Physics)
- Developed an experimental design for projects involving measurement of the optical properties of single cells in general and of Müller cells in particular. (U. Leipzig, Soft Matter Physics)
- Designed and assembled a roughing-pump manifold assembly able to efficiently support the large-scale system of interconnected vacuum chambers employed by the group. In addition, completed the assembly and testing of ultra-high vacuum apparatus to enclose an ion time-of-flight spectrometer. (U. Texas, High-intensity Laser Lab)
- Modified and extended a magnetic Kerr-effect imaging system employed in the analysis of thin-film magnetic samples. (U. Texas, Thin-film Magnetics Lab)
- Operated, maintained, and upgraded a dual-grating monochromator ion-laser based Raman microscopy system. (U. Washington, Physics)

R&D STARTUP COMPANY EXPERIENCE

- As Software Development team lead, designed and developed production-grade software for a computational Fourier microscopy whole-slide imaging system. (Clearbridge Biophotonics)
- As technical director of the company, created detailed specifications for a multi-year research and development project treating all aspects of a consolidation process utilizing nanoparticle ceramic oxide material. These specifications were submitted as grant proposals to the Federal Government's Small Business Innovative Research (SBIR) program. (Ksana)
- As technical director of the company, managed research organization and budgeting, hiring and firing of personnel, and drafting and presenting progress reports to the investors. (Laser Therapeutics)

EMPLOYMENT HISTORY

Senior Software Engineer — Sept 2014– May 2017
Clearbridge Biophotonics, Pte Ltd
Carlsbad, CA

CEO / Founder — Aug 2012 – Aug 2014
Ekapadi LLC
Austin, TX

Post-doctoral fellow / Research associate — June 2011 – July 2012
University of Texas at Austin, Section of Integrative Biology

Post-doctoral fellow — Jan 2011 – March 2011
University of Texas at Austin, Dept. of Biomedical Engineering

Graduate Research Assistant — June 2006 – Dec 2010
University of Texas at Austin, Dept. of Biomedical Engineering

Graduate Research Assistant — Jan 2004 – May 2006
University of Leipzig, Leipzig, Sachsen; Germany
Department of Physics and Geological Sciences
Institute for Soft Matter Physics

Graduate Research Assistant — Jan 2003 – Dec 2003
University of Texas at Austin, Dept. of Biomedical Engineering

Graduate Research Assistant — June 2001 – Aug 2002
University of Texas at Austin, Dept. of Physics
High-intensity Laser Lab

Graduate Research Assistant — June 2000 – May 2001
University of Texas at Austin, Dept. of Physics
Thin-film magnetics Lab

Student Research Assistant — Jan 2000 – May 2000
University of Washington, Dept. of Physics
Solid-state physics lab

Device Driver Engineer — Sept 1996 – May 1998
Silicon Reality, Inc.
Federal Way, WA

Senior Software Engineer — Jan 1994 – June 1996
Janicki Machine Design
Sedro Woolley, WA

Technical Director — May 1991 – Dec 1993
Ksana International, Inc.
Seattle, WA

Engineer, Laser Systems and Applications — Jan 1991 – Apr 1991
MBC International, Svenska KB
Göteborg, Sweden

Technical Director / Research Scientist May 1989 – Dec 1990
Laser Therapeutics, Ltd.
Seattle, WA

EDUCATION

Doctorate of Philosophy, Physics
Dissertation: “Optical Scattering from Nanoparticle Aggregates”
University of Texas at Austin Dec 2010

University of Leipzig; Germany Jan 2004 – July 2006

Master of Arts, Physics
University of Texas at Austin May 2004

Bachelor of Science, Physics
University of Washington, Seattle, WA
Dean’s list (all quarters of attendance) Dec 1999

PUBLICATIONS

I have authored, co-authored and made major contributions to 14 publications. For details, please see the *Publications* addendum.

FOREIGN LANGUAGES

German (intermediate working proficiency) and Mandarin (basic working proficiency).

PRIMARY ADDITIONAL INTERESTS

History of technology, human languages, science fiction, diving, bicycling.