

Curriculum Vitæ

Personal Data

NAME: Yuhua Song
WORK ADDRESS: Washington University in St. Louis School of Medicine
Department of Biochemistry and Molecular Biophysics
Center for Computational Biology
700 S. Euclid Ave.
St. Louis, MO 63110
Work Tel: (314) 3622017, Fax: (314) 3622934
E-mail: yhsong@ccb.wustl.edu
URL: <http://agave.wustl.edu/~yhsong>
HOME ADDRESS: 4482 Lindell BLVD #604
St. Louis, MO 63108
Home Tel: (314) 5333234, Fax: (314) 5333234
Cell Phone: (314) 3981286

Education

PH.D. IN MATERIALS SCIENCE & ENGINEERING, Harbin Institute of Technology, P. R. China, 1998 (thesis advisor: Prof. Kaifeng Zhang)
M.S. IN MATERIALS SCIENCE & ENGINEERING, Harbin University of Science and Technology, P. R. China, 1996 (thesis advisor: Prof. Shanzhi Ren)
B.S. (Honors) IN MATERIALS SCIENCE & ENGINEERING, Jilin University of Technology, P. R. China, 1989

Professional Experience

RESEARCH ASSOCIATE: Dec. 2002 – present (with Dr. Nathan A. Baker)
Center for Computational Biology,
Department of Biochemistry and Molecular Biophysics,
Washington University in St. Louis School of Medicine

COMPUTATIONAL BIOLOGY

- Substrate diffusion to biological macromolecules: development of a 3-D adaptive finite element diffusion software for substrate diffusion to biological macromolecules rate constant calculation including electrostatic potential effect. The software was applied to the biomolecular system of acetylcholinesterase for both wild type and mutants, laying the groundwork for integration of molecule-scale information into cellular-scale systems, such as the neuromuscular junction.
- Study the interaction of an amphiphilic molecule with biological membrane and its effect on the kinetic, structural, mechanical and electrostatic properties of the biological membrane with molecular dynamics simulation.

CELL MECHANICS

- Study the effect of focal adhesion between cell and extracellular matrix on the mechanical response of reconstituted model tissue with finite element analysis.

POSTDOCTORAL RESEARCHER: Feb. 2001 – Nov. 2002 (with Dr. Savio L-Y. Woo)
Musculoskeleton Research Center, Department of Orthopedic Surgery,
University of Pittsburgh School of Medicine

SOFT TISSUE BIOMECHANICS AND ORTHOPEDIC BIOMECHANICS

- Combined experimental/computational approach was used for the development of the subject specific finite element model of the anterior cruciate ligament (kinematics driven model).
- 3-D Finite element model of the knee joint (force driven model) to analyze both the knee kinematics and force, stress distribution in the ACL.

UNIX SYSTEM ADMINISTRATOR: Feb. 2001 – Nov. 2002

Musculoskeleton Research Center, University of Pittsburgh School of Medicine

POSTDOCTORAL RESEARCHER: Jan. 1999 – Jan. 2001 (with Prof. Yongnian Yan, Prof. Renji Zhang)

Center of Laser Rapid Forming & Bio-Manufacturing Engineering,
Department of Mechanical Engineering,
Tsinghua University, P. R. China

RAPID PROTOTYPING & RAPID TOOLING

- Dimensional accuracy for casting dies of automobile deck part in rapid tooling: non-linear coupled thermo-mechanical finite element analysis.
- Coupled thermo-mechanical analysis of laminated object manufacturing.

EQUIPMENT DESIGN

- Prestress wire-winding press: strength and stiffness finite element analysis. (industry collaborated project)

UNIX SYSTEM ADMINISTRATOR: Jan. 1999 – Jan. 2001

Center of Laser Rapid Forming & Bio-Manufacturing Engineering,
Department of Mechanical Engineering, Tsinghua University, P. R. China

RESEARCH ASSISTANT: March 1996 – Nov. 1998

Department of Materials Science & Engineering,
Harbin Institute of Technology, P. R. China

PLASTIC SHEET THERMOFORMING

- Development of finite element software for the coupled thermo-mechanical analysis of the plastic sheet thermoforming to predict the thickness, temperature, and thermal stress distribution, and analyze the warpage of the thermoforming plastic part.

RESEARCH ASSISTANT: Sep. 1993 – March 1996

Department of Materials Science & Engineering,
Harbin University of Science and Technology, P. R. China

DUCTILE ION CASING SOLIDIFICATION

- Development of numerical analysis software for analysis of temperature distribution and shrinkage prediction during solidification process of the ductile ion casting.

ENGINEER: July 1989 – Sep. 1993

Harbin Bicycle Industry Co., P. R. China

MOLD DESIGN AND MANUFACTURING

- Stamping mold design and manufacturing.

Selected Honors

NATIONAL AWARD OF SCIENCE AND TECHNOLOGY ADVANCEMENT: Second Prize (member): (2003) State of Council of P. R. China. Project: MultipleFunction Rapid Prototyping Manufacturing System

BEIJING MUNICIPALITY AWARD OF SCIENCE AND TECHNOLOGY ADVANCEMENT: First Prize (member): (2001) Beijing municipality, P.R. China. Project: MultipleFunction Rapid Prototyping Manufacturing System

BEIJING MUNICIPALITY AWARD OF SCIENCE AND TECHNOLOGY ADVANCEMENT: Second Prize (member): (2001) Beijing municipality, P.R. China. Project: Application of the rapid prototyping/rapid tooling technique on the manufacturing of the mold and parts.

POSTDOCTORAL FELLOWSHIP: (2000) China National Science Foundation

HUAWEI SCHOLARSHIP: (1998) Harbin Institute of Technology

SCHOLARSHIP: (1985-1989) Jilin University of Technology

SCHOLARSHIP FOR THE GRACE HOPPER CELEBRATION OF WOMEN IN COMPUTING: (2002) Institute for Women and Technology

POSTDOCTORAL FELLOWSHIP (2004, PENDING) Life Sciences Research Foundation

Professional Affiliations

MEMBER: Biophysical Society (2004)

MEMBER: Biomedical Engineering Society (2003-2004).

MEMBER: American Society of Mechanical Engineers (2002-2003).

Relevant Skills

Computer Skills

C, Fortran, Python, Matlab, and Mathematics:	programming
MSC. MARC and ABAQUS:	non-linear Finite Element software
MSC. PATRAN:	geometry modeling software
MIMICS:	CT, MRI 3D image processing software
AMBER and GROMACS:	molecular dynamics simulation software

Languages

CHINESE: native language

ENGLISH: second language

EDUCATIONAL CONTRIBUTIONS

Students

LING PEI: (April 2000 – June 2001) Graduate student, help to advise for Prof. Renji Zhang Tsinghua University, P. R. China.

CHAZ VUKOTICH: (May 2001 – August 2001) Summer undergraduate student researcher, University of Pittsburgh.

CHRISTINA CASSELLA: (May 2002 – August 2002) Summer undergraduate student researcher, University of Pittsburgh.

MARA SCHENKER: (Sep. 2002 – Nov. 2002) Undergraduate researcher, University of Pittsburgh.

PROFESSIONAL CONTRIBUTIONS

Manuscript Reviews

JOURNAL OF BIOMECHANICS
POLYMER ENGINEERING AND SCIENCE
MATERIALS & DESIGN
JOURNAL OF MECHANICS IN MEDICINE AND BIOLOGY (panel review)
CLINICAL BIOMECHANICS (panel review)
JOURNAL OF ORTHOPAEDIC RESEARCH (panel review)
THE JOURNAL OF ARTHROSCOPIC AND RELATED SURGERY (panel review)

RESEARCH INTERESTS

- COMPUTATIONAL BIOLOGY
- COMPUTATIONAL BIOMECHANICS
- MOLECULAR, CELL AND TISSUE ENGINEERING
- COUPLED THERMO-MECHANICAL ANALYSIS OF MATERIALS PROCESSING PROCEDURE:
- MOLD AND EQUIPMENT DESIGN AND MANUFACTURING

PUBLICATIONS & PRESENTATIONS

Manuscripts in preparation

1. **Yuhua Song**, Nathan A. Baker. Molecular dynamics simulation of the effect of salicylate on the properties of dipalmitoylphosphatidylcholine bilayer with NaCl
2. **Yuhua Song**, Nathan A. Baker. Finite element solution of the time-dependent Smoluchowski equation for rate constant calculations
3. **Yuhua Song**, Guy M. Genin, Elliot Elson, Nathan A. Baker. Effect of focal adhesion between cell and matrix on the mechanical response of the reconstituted model tissue
4. **Yuhua Song**, Savio L-Y. Woo et al. Subject specific finite element model of the anterior cruciate ligament (under internal review in MSRC, University of Pittsburgh)
5. **Yuhua Song**, Savio L-Y. Woo et al. Development of a three dimensional nonlinear finite element model of the human knee joint (under internal review in MSRC, University of Pittsburgh)
6. **Yuhua Song**, Savio L-Y. Woo et al. Variation between Knees on the *in situ* Force in the Anterior Cruciate Ligament (under internal review in MSRC, University of Pittsburgh)

Journal articles

1. **Yuhua Song**, Yongjie Zhang, Chandrajit L. Bajaj, Nathan A. Baker. Continuum diffusion reaction rate calculations of wild type and mutant mouse acetylcholinesterase: adaptive finite element analysis. *Biophys J.* 2004 Sep.; 87(3):1558-1566.
2. **Yuhua Song**, Yongjie Zhang, Tongye Shen, Chandrajit L. Bajaj, J. Andrew McCammon and Nathan A. Baker. Finite element solution of the steady-state

- Smoluchowski equation for rate constant calculations. *Biophys J.* 2004 Apr; 86(4):2017-29.
3. Deqiang Zhang, Jason Suen, Yongjie Zhang, **Yuhua Song**, Zoran Radic, Palmer Taylor, Michael J. Holst, Chandrajit Bajaj, Nathan A. Baker, J. Andrew McCammon. Tetrameric mouse acetylcholinesterase: continuum diffusion rate calculations by solving the steady-state smoluchowski equation using finite element methods (submitted to *Biophys J.* 2004)
 4. **Yuhua Song**, Richard E. Debski, Volker Musahl, Maribeth Thomas, Savio L-Y. Woo. A three dimensional finite element model of the human anterior cruciate ligament – a computational analysis with experimental validation. *J Biomech.* 2004 Mar; 37(3):383-90.
 5. **Yuhua Song**, Yongnian Yan, Renji Zhang etc. Boundary model between casting and matrix and its influence on the dimensional accuracy analysis of rapid tooling. *Proceeding of the institution of mechanical engineers Part B - Journal of Engineering Manufacture*, 2002; 216 (8): 1123-1134
 6. **Yuhua Song**, Yongnian Yan, Renji Zhang etc. Manufacture of the die of automobile deck part based on rapid prototyping and rapid tooling technology. *Journal of Materials Processing Technology*, 2002 Jan; Vol 20 n1-3: 237-242
 7. **Yuhua Song**, Yongnian Yan, Renji Zhang Qingping Lu etc. 3-D non-linear coupled thermomechanical finite element analysis of the dimensional accuracy for casting dies in rapid tooling. *Finite Elements in Analysis and Design*, 2001; 38 (1): 79-91.
 8. **Yuhua Song**, Kaifeng Zhang, Zhongren Wang, Faxi Dao, Yongnian Yan, etc. Coupled thermo-mechanical analysis of plastics thermoforming. *Polymer Engineering and Science*, 2000 Aug.; 40(8): 1736-1746.
 9. **Yuhua Song**, Kaifeng Zhang, Zhongren Wang, Faxi Diao. 3-D FEM analysis of temperature field and thermal stress for plastics thermoforming. *Journal of Materials Processing Technology*, 2000 Jan; 97(1-3): 35-43.
 10. **Yuhua Song**, Kaifeng Zhang, Zhongren Wang, Faxi Diao. Study on the warpage of plastics vacuum- forming process. *Journal of Reinforced Plastics and Composites*, 1999; 18(10): 931-941.

Journal articles (in Chinese with English abstract)

1. **Yuhua Song**, Yongnian Yan, Zhang Renji. Coupled thermo-mechanical FEM analysis of laminated object manufacturing. *China Mechanical Engineering*. 2000; Vol. 11, Suppl.: 37-40.
2. **Yuhua Song**, Kaifeng Zhang, Zhongren Wang. 3-D FEM analysis of temperature field for plastic sheet thermoforming. *Journal of Plasticity Engineering*, 1998 Dec.; 5(4): 33-41
3. Kaifeng Zhang, **Yuhua Song**. Analysis of thickness distribution control process of vacuum forming part by rigid visco-plastic shell FEM. *Journal of Plasticity Engineering*, 1997 Sep.; 4(3):38-42
4. Kaifeng Zhang, **Yuhua Song**, Zhongren Wang. Study of latent heat disposal during FEM analysis of 3-D temperature field of plastic thermoforming. *Material Science and Technology*, 1998: 6(2):83-87

5. **Yuhua Song**, Shanzhi Ren, Fengyu Qing. The experimental research and realization on computer about 3-Dimensional shrinkage prediction of ductile iron casting. *Materials Science & Technology*, 1997; 5(1): 114-116.

Conference papers

1. **Yuhua Song**, Yongnian Yan, Da Xu, Renji Zhang and Qingping Lu. Application of the dimensional accuracy analysis in rapid tooling. *The 8th International Conference on Rapid Prototyping*, 2000 June 12-13, TOKYO, Japan, pp364-370.
2. Kaifeng Zhang, Wei Wu, **Yuhua Song**. Some technical problems in rigid viscoplastic FEM. *NUMIFORM'98*, 1998, Netherland, pp753-758.
3. **Yuhua Song**, S. P. Wu, F. Y. Qing, S. Z. Ren. Study on searching for isolated region during casting solidification process and predicting second shrinkage of ductile iron casting. *3rd Pacific Rim International Conference on Modeling of Casting and Solidification Processes*, 1996 Dec, Beijing, China, International Academic Publishers, pp353-358.

Selected abstracts

1. **Yuhua Song**, Nathan A. Baker. Effect of salicylate on lipid bilayer mechanics and electrostatics. (Accepted by *Biophysical Society 49th Annual meeting*, Feb. 2005)
2. **Yuhua Song**, Yongjie Zhang, Tongye Shen, Chandrajit L. Bajaj, J. Andrew McCammon and Nathan A. Baker. Finite element solution of the steady-state diffusion equation for rate constant calculations. *Biophysical Society Meeting*. Feb.2004.
3. **Yuhua Song**, Yongjie Zhang, Tongye Shen, Chandrajit L. Bajaj, J. Andrew McCammon and Nathan A. Baker. Computational modeling of biomolecular diffusion. *17th Annual Gibbs Conference on Biothermodynamics*. Sep. 2003. Poster.
4. **Yuhua Song**, Richard E. Debski, Maribeth Thomas, Savio L-Y. Woo. Force and stress distribution of the ACL is affected by the ACL wrapping around the femoral condyle under anterior tibial load, *Orthopedic Research Society Meeting*, February 2-5, 2003 in New Orleans, LA.
5. **Yuhua Song**, Richard E. Debski, Jorge Gil, Savio L-Y. Woo. Development of a 3-D non-linear finite element model of human knee joint. BED-9C, Joint Biomechanics I, Advances in Bioengineering, *American Society of Mechanical Engineers Meeting*, New Orleans, Nov.22, 2002.
6. **Yuhua Song**, Richard E. Debski et al. Stress distribution within the anteromedial and posterolateral bundles of ACL under anterior tibial load. *10th Annual symposium on computational methods in orthopaedic biomechanics*, Dallas, TX, Feb. 9, 2002.

Technical reports

- **Yuhua Song**. Coupled thermo-mechanical finite element analysis for rapid prototyping and rapid tooling, and finite element analysis for prestress wire-winding press. *Postdoctoral Research Report*, Beijing: Tsinghua University, 2000.

Dissertation and Thesis

- **Yuhua Song**. Coupled thermo-mechanical 3-D finite element analysis for plastic thermoforming. *Ph. D. Dissertation*, Harbin: Harbin Institute of Technology, 1998.
- **Yuhua Song**. The three dimensional numerical simulation software package for solidification process and shrinkage prediction of ductile iron castings. *Master thesis*, Harbin: Harbin University of Science and Technology, 1996.