

# Pat Banerjee

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Pat Banerjee received the B.Tech. degree in mechanical engineering from the Indian Institute of Technology, Kanpur, in 1984, and the M.S. and Ph.D. degrees in industrial engineering from Purdue University, West Lafayette, IN, in 1987 and 1990, respectively. He is currently a Professor in the Department of Mechanical and Industrial Engineering and of Computer Science with the University of Illinois, Chicago.

He was on the 2002 Research Visionary Board at Motorola Laboratories. His current research interests include virtual reality applications; haptics applications; sensors, diagnostics, and prognostics; immersive learning effectiveness and display interfaces; and linear and nonlinear design optimization models. He is the author of over 100 publications, including a textbook Virtual Manufacturing (Wiley, 2001). He was a Department Editor of the IIE Transactions.

Prof. Banerjee is a Fellow of the American Society of Mechanical Engineers (ASME). He received the ASME MED/MHED Best Technical Paper Award. He was an Associate Editor of the IEEE TRANSACTIONS ON ROBOTICS AND AUTOMATION.

## SCOPUS author statistics

Documents: 97

Citations: 2880 total citations by 2662 documents

h-index: 21

Co-authors: 140

## Research Interests

ImmersiveTouch: Haptics and virtual reality applications in medicine

Industrial Virtual Reality Institute: Local and telecollaborative industrial virtual reality applications

Manufacturing systems design, product design and prognostics

## Awards, Honors, and Membership

Associate Editor, IEEE Transactions on Information Technology in Biomedicine, 2007-Present

Fellow, American Society of Mechanical Engineers, 2003

UIC Research Award, 2000

U.S. Army Summer Fellowship, 2000

ASME Best Technical Paper Award, 1999

Associate Editor, IEEE Transactions on Robotics & Automation, 1998-2001

1996-2001 Department Editor, IIE Transaction

## Publications

### Invention Disclosures, Provisional Patents and Patents

P. Banerjee, C. Luciano, L. Florea, G. Dawe, “Mini Personal Haptic Virtual and Augmented Reality Immersive System”, Invention Disclosure CY033, University of Illinois at Chicago, December 2004

P. Banerjee, C. Luciano, L. Florea, G. Dawe, “Compact haptic and augmented virtual reality device”, U.S. Provisional Patent Application No. 60/646,837, March 2005

P. Banerjee and C. Luciano, “Compact haptic and augmented virtual reality system”, U.S. Patent Application, January 2006

Pat Banerjee, Cristian Luciano, Michael Lemole, Fady Charbel, “Immersive Touch Neurological Simulator”, Invention Disclosure CY084, University of Illinois at Chicago, May 2005

### Journal Articles

Roitberg, B. Z., Kania, P., Luciano, C., Dharmavaram, N. & Banerjee, P. 2015 “Evaluation of Sensory and Motor Skills in Neurosurgery Applicants Using a Virtual Reality Neurosurgical Simulator: The Sensory-Motor Quotient” In : Journal of Surgical Education.

Sikder, S., Luo, J., Banerjee, P. P., Luciano, C., Kania, P., Song, J. C., Skahtani, E., Edward, D. P. & Al Towerki, A. E. Jan 20 2015 "The use of a virtual reality surgical simulator for cataract surgical skill assessment with 6 months of intervening operating room experience" In : Clinical Ophthalmology. 9, p. 141-149 9 p.

Shakur, S. F., Luciano, C. J., Kania, P., Roitberg, B. Z., Banerjee, P. P., Slavin, K. V., Sorenson, J., Charbel, F. T. & Alaraj, A. Sep 1 2015 "Usefulness of a virtual reality percutaneous trigeminal rhizotomy simulator in neurosurgical training" In : Clinical Neurosurgery. 11, p. 420-425 6 p.

Alaraj, A., Luciano, C. J., Bailey, D. P., Elsenousi, A., Roitberg, B. Z., Bernardo, A., Banerjee, P. P. & Charbel, F. T. Mar 1 2015 "Virtual reality cerebral aneurysm clipping simulation with real-time haptic feedback" In : Neurosurgery. 11, p. 52-58 7 p.

Al Harthi, K., Al Shahwan, S., Al Towerki, A., Banerjee, P. P., Behrens, A. & Edward, D. P. Dec 1 2014 "Comparison of the anterior capsulotomy edge created by manual capsulorhexis and 2 femtosecond laser platforms: Scanning electron microscopy study" In : Journal of Cataract and Refractive Surgery. 40, 12, p. 2106-2112 7 p.

Patel, A., Koshy, N., Ortega-Barnett, J., Chan, H. C., Kuo, Y. F., Luciano, C., Rizzi, S., Matulyauskas, M., Kania, P., Banerjee, P. & Gasco, J. Dec 1 2014 "Neurosurgical tactile discrimination training with haptic-based virtual reality simulation" In : Neurological Research. 36, 12, p. 1035-1039 5 p.

Sikder, S., Tuwairqi, K., Al-Kahtani, E., Myers, W. G. & Banerjee, P. Feb 2014 "Surgical simulators in cataract surgery training" In : British Journal of Ophthalmology. 98, 2, p. 154-158 5 p.

Kozak, I., Banerjee, P., Luo, J. & Luciano, C. Mar 31 2014 "Virtual reality simulator for vitreoretinal surgery using integrated OCT data" In : Clinical Ophthalmology. 8, p. 669-672 4 p.

Gasco, J., Patel, A., Ortega-Barnett, J., Branch, D., Desai, S., Kuo, Y. F., Luciano, C., Rizzi, S., Kania, P., Matulyauskas, M., Banerjee, P. & Roitberg, B. Z. Nov 1 2014 "Virtual reality spine surgery simulation: An empirical study of its usefulness" In : Neurological Research. 36, 11, p. 968-973 6 p.

Gasco, J., Patel, A., Luciano, C., Holbrook, T., Ortega-Barnett, J., Kuo, Y. F., Rizzi, S., Kania, P., Banerjee, P. & Roitberg, B. Z. Dec 2013 "A novel virtual reality simulation for hemostasis in a brain surgical cavity: Perceived utility for visuomotor skills in current and aspiring neurosurgery residents" In : World Neurosurgery. 80, 6, p. 732-737 6 p.

Luciano, C. J., Banerjee, P. P., Sorenson, J. M., Foley, K. T., Ansari, S. A., Rizzi, S., Germanwala, A. V., Kranzler, L., Chittiboina, P. & Roitberg, B. Z. Jan 2013 "Percutaneous spinal fixation simulation with virtual reality and haptics" In : Neurosurgery. 72, SUPPL. 1

Yudkowsky, R., Luciano, C., Banerjee, P., Schwartz, A., Alaraj, A., Lemole, G. M., Charbel, F., Smith, K., Rizzi, S., Byrne, R., Bendok, B. & Frim, D. Feb 2013 "Practice on an augmented reality/haptic simulator and library of virtual brains improves residents' ability to perform a ventriculostomy" In : Simulation in Healthcare. 8, 1, p. 25-31 7 p.

Alaraj, A., Charbel, F. T., Birk, D., Tobin, M., Luciano, C., Banerjee, P. P., Rizzi, S., Sorenson, J., Foley, K., Slavin, K. & Roitberg, B. Jan 2013 “Role of cranial and spinal virtual and augmented reality simulation using immersive touch modules in neurosurgical training” In : Neurosurgery. 72, SUPPL. 1

Roitberg, B., Banerjee, P., Luciano, C., Matulyauskas, M., Rizzi, S., Kania, P. & Gasco, J. Oct 2013 “Sensory and motor skill testing in neurosurgery applicants: A pilot study using a virtual reality haptic neurosurgical simulator” In : Neurosurgery. 73, SUPPL. 4

Yoganandan, A. R., Pat Banerjee, P., Luciano, C. J. & Rizzi, S. H. R. Mar 2012 “Prototyping flexible touch screen devices using collocated haptic-graphic elastic-object deformation on the GPU” In : Virtual Reality. 16, 1, p. 33-43 11 p.

Luciano, C. J., Banerjee, P. P., Bellotte, B., Oh, G. M., Lemole, M., Charbel, F. T. & Roitberg, B. Sep 2011 “Learning retention of thoracic pedicle screw placement using a high-resolution augmented reality simulator with haptic feedback” In : Neurosurgery. 69, SUPPL. 1

Luciano, C., Banerjee, P. & DeFenti, T. 2009 “Haptics-based virtual reality periodontal training simulator” In : Virtual Reality. 13, 2, p. 69-85 17 p.

Lemole, M., Banerjee, P. P., Luciano, C., Charbel, F. & Oh, M. May 2009 “Virtual ventriculostomy with 'shifted ventricle': Neurosurgery resident surgical skill assessment using a high-fidelity haptic/graphic virtual reality simulator” In : Neurological Research. 31, 4, p. 430-431 2 p.

Banerjee, P. P., Luciano, C. J., Lemole, G. M., Charbel, F. T. & Oh, M. Y. Sep 2007 “Accuracy of ventriculostomy catheter placement using a head- And hand-tracked high-resolution virtual reality simulator with haptic feedback” In : Journal of Neurosurgery. 107, 3, p. 515-521 7 p.

Banerjee, P. P., Ávila, R., He, D., Wu, S. & Bechhoefer, E. Nov 2007 “Discriminant analysis based prognostics of avionic systems” In : IEEE Transactions on Systems, Man and Cybernetics Part C: Applications and Reviews. 37, 6, p. 1318-1326 9 p.

Liu, H., Darabi, H., Banerjee, P. & Liu, J. Nov 2007 “Survey of wireless indoor positioning techniques and systems” In : IEEE Transactions on Systems, Man and Cybernetics Part C: Applications and Reviews. 37, 6, p. 1067-1080 14 p.

Lemole, G. M., Banerjee, P. P., Luciano, C., Neckrysh, S. & Charbel, F. T. Jul 2007 “Virtual reality in neurosurgical education: Part-task ventriculostomy simulation with dynamic visual and haptic feedback” In : Neurosurgery. 61, 1, p. 142-148 7 p.

Banerjee, P. P., Luciano, C. J. & Rizzi, S. Jun 2007 “Virtual Reality Simulations” In : Anesthesiology Clinics. 25, 2, p. 337-348 12 p.

Dong, M., He, D., Banerjee, P. & Keller, J. Oct 2006 “Equipment health diagnosis and prognosis using hidden semi-Markov models” In : International Journal of Advanced Manufacturing Technology. 30, 7-8, p. 738-749 12 p.

Darabi, H., Banerjee, P. & Liang, S. 2006 "Supervisory control framework for collaborative virtual manufacturing" In : International Journal of Industrial and Systems Engineering. 1, 4, p. 429-445 17 p.

Akgunduz, A., Banerjee, P. & Mehrotra, S. Mar 2005 "A linear programming solution for exact collision detection" In : Journal of Computing and Information Science in Engineering. 5, 1, p. 48-55 8 p.

Banerjee, P. & Basu-Mallick, D. Jun 2003 "Measuring the effectiveness of presence and immersive tendencies on the conceptual design review process" In : Journal of Computing and Information Science in Engineering. 3, 2, p. 166-169 4 p.

Gierach, K., Thompson, D. & Banerjee, P. Apr 2002 "An approach for facilitating service management in networked virtual manufacturing environments" In : Robotics and Computer-Integrated Manufacturing. 18, 2, p. 147-156 10 p.

Akgunduz, A., Zetu, D., Banerjee, P. & Liang, D. Feb 2002 "Evaluation of sub-component alternatives in product design processes" In : Robotics and Computer-Integrated Manufacturing. 18, 1, p. 69-81 13 p.

Akgunduz, A., Banerjee, P. & Mehrotra, S. Feb 2002 "Smart collision information processing sensors for fast moving objects" In : Smart Materials and Structures. 11, 1, p. 169-174 6 p.

Luciano, C., Banerjee, P. & Mehrotra, S. Dec 2001 "3D animation of telecollaborative anthropomorphic avatars: A high-performance solution offers faster 3D representation of users by avatars without compromising real-time interactivity" In : Communications of the ACM. 44, 12, p. 64-67 4 p.

Tesic, R. & Banerjee, P. Jan 2001 "Exact collision detection for a virtual manufacturing simulator" In : IIE Transactions (Institute of Industrial Engineers). 33, 1, p. 43-54 12 p.

Banerjee, A., Banerjee, P., DeFanti, T., Hudson, A., Dodds, B. & Curtis, J. R. 2000 "A behavioral layer architecture for telecollaborative virtual manufacturing operations" In : IEEE Transactions on Robotics and Automation. 16, 3, p. 218-227 10 p.

Hua, Z. & Banerjee, P. Jul 20 2000 "Aggregate line capacity design for PWB assembly systems" In : International Journal of Production Research. 38, 11, p. 2417-2441 25 p.

Hua, Z., Liang, L. & Banerjee, P. Jan 2000 "Approximate approach to capacity expansion problem for PWB assembly lines" In : Chinese Journal of Electronics. 9, 1, p. 100-107 8 p.

Banerjee, A. & Banerjee, P. Jun 2000 "Behavioral scene graph for rule enforcement in interactive virtual assembly sequence planning" In : Computers in Industry. 42, 2, p. 147-157 11 p.

Zetu, D., Banerjee, P. & Thompson, D. Jun 2000 "Extended-range hybrid tracker and applications to motion and camera tracking in manufacturing systems" In : IEEE Transactions on Robotics and Automation. 16, 3, p. 281-293 13 p.

Hua, Z. & Banerjee, P. Aug 2000 “Model for line capacity design for PWB assembly systems” In : Robotics and Computer-Integrated Manufacturing. 16, 4, p. 241-257 17 p.

Thompson, D., Banerjee, A., Banerjee, P., DeFanti, T. & Retterer, S. Apr 2000 “Tele-immersive product evaluation: A review and an implementation framework” In : Robotics and Computer-Integrated Manufacturing. 16, 2, p. 181-190 10 p.

Gunduz, A., Zetu, D. & Banerjee, P. Nov 2000 “Viewpoint-based shape recovery from multiple views” In : Artificial Intelligence for Engineering Design, Analysis and Manufacturing: AIEDAM. 14, 5, p. 359-372 14 p.

Ye, N., Banerjee, P., Banerjee, A. & Dech, F. 1999 “A comparative study of assembly planning in traditional and virtual environments” In : IEEE Transactions on Systems, Man and Cybernetics Part C: Applications and Reviews. 29, 4, p. 546-555 10 p.

Giallorenzo, V., Banerjee, P., Conroy, L. & Franke, J. 1999 “Application of virtual reality in hospital facilities design” In : Virtual Reality. 4, 3, p. 223-234 12 p.

Banerjee, A., Banerjee, P., Ye, N. & Dech, F. Apr 1999 “Assembly planning effectiveness using virtual reality” In : Presence: Teleoperators and Virtual Environments. 8, 2, p. 204-217 14 p.

Banerjee, A. & Banerjee, P. Mar 1999 “Design-for-maintenance of digital assets” In : International Journal of Industrial Engineering : Theory Applications and Practice. 6, 1, p. 72-80 9 p.

Tesic, R. & Banerjee, P. 1999 “Exact collision detection using virtual objects in virtual reality modeling of a manufacturing process” In : Journal of Manufacturing Systems. 18, 5, p. 367-376 10 p.

Banerjee, P., Banerjee, A. & Tesic, R. Mar 1999 “Optimization-based planning heuristic for material flow congestion avoidance in conveyor network design” In : Production Planning and Control. 10, 2, p. 181-193 13 p.

Zetu, D., Banerjee, P. & Schneider, P. 1998 “Data input model for virtual reality-aided facility layout” In : IIE Transactions (Institute of Industrial Engineers). 30, 7, p. 597-620 24 p.

Banerjee, P., Zhou, Y. & Montreuil, B. 1997 “Genetically assisted optimization of cell layout and material flow path skeleton” In : IIE Transactions (Institute of Industrial Engineers). 29, 4, p. 277-291 15 p.

## Conference Proceedings

C. Luciano, P. Banerjee, L. Florea, G. Dawe “Design of the ImmersiveTouch™: a High-Performance Haptic Augmented Virtual Reality System” CD ROM Proc. Of Human-Computer Interaction (HCI) International Conf., Las Vegas, July 2005

Cristian Luciano, Pat Banerjee, G. Michael Lemole, Jr. and Fady Charbel, "Second Generation Haptic Ventriculostomy Simulator Using The Immersivetouch™ System", Proceedings Medicine Meets Virtual Reality, 2006, pp. 343-348

Liang, S., Banerjee, P. P. & Edward, D. P. 2009 "A high performance graphic and haptic curvilinear capsulorrhesis simulation system." Proceedings of Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Conference. p. 5092-5095 4 p.