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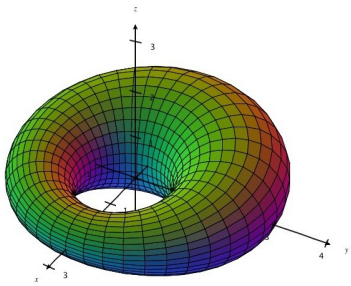
Interdisciplinary collaboration between engineering, mathematics and science

SEMS Research Highlights



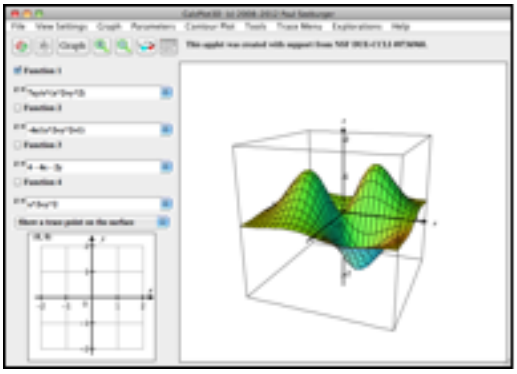
Improving Conceptual Understanding of Multivariable Calculus Through Visualization Using CalcPlot3D

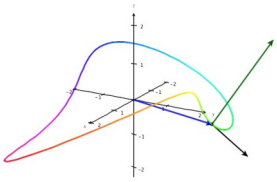
P. Seeburger and M. VanDieren

This newsletter presents the research conducted within the School of Engineering, Mathematics and Science (SEMS) at Robert Morris University (RMU). It covers various relevant topics including: interdisciplinary efforts, successful research grants, student research, posters and papers, journal publications, presentations at national and international conferences, contribution to professional societies, STEM educational research, industrial consulting collaborations and applied research.

It is recognized that visualization is an important learning mechanism. However, some students have difficulty in imagining the motion and geometric relationships between the various abstract notions developed in calculus. The three-dimensional concepts of multivariable calculus seem especially difficult to visualize . RMU professor Monica VanDieren has been addressing these challenges since 2010, by guiding students in weekly hands-on computer labs using an applet called CalcPlot3D in her multivariable calculus classes. The CalcPlot3D applet provides a concrete tool to visualize, manipulate, and experiment with three-dimensional and abstract notions and formulas.

CalcPlot3D is a NSF-funded, dynamic visualization tool that was developed by Paul Seeburger of Monroe Community College in Rochester, NY. This applet has won the 2010 ICTCM Award for Excellence and Innovation with the Use of Technology in Collegiate Mathematics and the 2011 MERLOT Award for Exemplary Online Learning Resources in Mathematics. Beyond multivariable calculus, the applet can be used for visualizing concepts in physics, engineering, differential equations, and linear algebra. VanDieren has served as a peer reviewer of early versions of this applet and has helped Seeburger train other instructors to use the program at the annual Joint Mathematics Meetings.





VanDieren is currently collaborating with Seeburger in developing new visual concept labs and classroom materials; expanding the capabilities of CalcPlot3D; and producing online, self-graded versions of the explorations in WeBWorK. They are interested in researching how student understanding improves through the use of the applet. The applet can be accessed at this website: web.monroecc.edu/calcNSF/

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