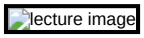

Visions for Quantitative Biology Lecture Series

What Does Radar Have To Do With Solving Sets of Linear Equations

Dr. Paul Saylor
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Lockett Hall 285
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Abstract:
The scattering amplitude arises in the mathematical modeling radar. There is a surprising connection, pointed out by Karl Warnick, to the Golub theory of error estimation for the conjugate gradient method (CG), a theory based on the connection between CG and Gaussian quadrature. (CG is a method to solve linear sets of equations.) The theory gives a stopping criterion different from the usual stopping criterion used in codes. (A stopping criterion decides when a code halts with a satisfactory approximation.) Warnick's observation makes it possible to compare the two criteria mathematicaly. An observation on constraint matrices comes as an aside. The connection to the topic of scattering amplitude results from an expression for the scattering amplitude as a constraint. In general, constraint enforcement yields a so-called saddle point matrix, but the saddle point formulation often sacrafices the computational law that orthogonality excels in numberical behavior as well as mathematical elegance. Orthogonal projection is easily done but leads to an odd-looking and different matrix. On the one hand there is a familiar saddle point matrix with an undesirable property and on the other an unfamiliar matrix with a desirable property. Constraint matrices also result from enforcing the invariance of energy and momentum and other quantities in the simulation of the merger of compact astrophysical objects.

Speaker's Bio:
Paul Saylor is a Professor in the Computer Science Department at the University of Illinois. Paul Saylor completed the Ph.D requirements in Mathematics at Rice University in 1967. Also in 1967, he joined the Computer Science Department at the University of Illinois, Urbana-Champaign, where he has remained, except for short term absences. He has been a consultant at Yale University and a Visiting Professor at the Swiss Federal Insitute of Technology in Zuerich.

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