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Network Models for Seismicity

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For my summer vacation scholarship I investigated seismology modeling, supervised by Prof Phil Pollett. My aim was to model the release and transfer of stress in a networked series of nodes. In order to take advantage of network models for Markov Chains, stress was assumed to be transferred as quanta.

I initially looked at stress increase and release for a single node, under three sets of situations. In each case my aim was to find and graph the stationary distribution. In Model I, stress increases at a constant rate, and is released at a rate dependent on both the stress level and size of the release. Model Ia was a model I node, where the rate of stress release was zero when stress was negative, and constant above it. Model II was Model I altered to include stress increasing in a jump (of size equal to or greater than one).

Model Ia was compared with the continuous equivalent found in the Vere-Jones paper 'On the Variance Properties of Stress-Release Models', and the distributions were quite similar for positive stress, but differed when stress was negative.

I next investigated a system of two connected nodes. Under the set conditions, the stationary distribution of the system was found to be the product of the stationary distribution of the two individual nodes. In this case, the stationary distribution of the first node was equivalent to Model I and the second to Model II.

Finally, I looked at systems of J nodes. For the case where stress can only increase or decrease in single increments, an open migration model (as detailed in Frank Kelly's 'Reversibility and Stochastic Networks') may be used to produce the stationary distribution. Summary statistics were used to give a graphical representation of the results.

I found participating in vacation research to be an enjoyable and valuable experience. The skills I acquired during this time will be particularly useful in my honours year, where I will be continuing research in stochastic modeling.

Jeanette received an ICE-EM Vacation Scholarship in December 2005.
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