WPI MATHEMATICAL SCIENCES

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PhD Candidate

Mathematical Sciences

April 10, 2019

Salisbury Labs, Room 406

10:00AM – 1:00PM

Dissertation Committee:

Dr. Stephan Sturm, WPI (Advisor)
Dr. Agostino Capponi, Columbia University
Dr. Igor Cialenco, Illinois Institute of Technology
Dr. Randy Paffenroth, WPI
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PhD Dissertation Presentation

Title: In the Wake of the Financial Crisis – Regulators' and Investors' Perspectives

Abstract: Before the 2008 financial crisis, most research in financial mathematics focused on the risk management and options' pricing without considering effects of counterparties' default, illiquidity problems, systemic risk and the role of the repurchase agreement (Repo). During the 2008 financial crisis, a frozen repo market led to a shutdown of short sales in the stock market. Cyclical interdependencies among corporations caused that a default of one firm seriously affected other firms and even the whole financial network.

In this dissertation, we will consider financial markets which are shaped by financial crisis. This will be done from two distinct perspectives, an investor's and a regulator's. From an investor's perspective, recently models were proposed to compute the total valuation adjustment (XVA) of derivatives without considering a potential crisis in the market. In our research, we include a possible crisis by apply an alternating renewal process to describe a switching between a normal financial status and a financial crisis status. We develop a framework for pricing the XVA of a European claim in this state-dependent framework. We represent the price as a solution to a backward stochastic differential equation and prove the solution's existence and uniqueness.

To study financial networks from a regulator's perspective, one popular method is the fixed-point based approach by L. Eisenberg and T. Noe. However, in practice, there is no accurate record of the interbank liabilities and thus one has to estimate them to use Eisenberg and Noe type models. In our research, we conduct a sensitivity analysis of the Eisenberg and Noe framework, and quantify the clearing payment's sensitivity to such estimation errors. We show that the effect of the missing specification of interbank connection to clearing payments can be described via directional derivatives that can be represented as solutions of fixed point equations. We also compute the probability of observing clearing payment deviations of a certain magnitude.