REPORT DOCUMENTATION PAGE

Form Approved OMB NO. 0704-0188

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1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (From - To)
10-09-2018	Final Report	29-May-2017 - 28-May-2018

4. TITLE AND SUBTITLE
Final Report: Conference Proposal: "Nonlinear PDEs, Stochastic Control, and Filtering: New Methods and Applications"

5a. CONTRACT NUMBER
W911NF-17-1-0284

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
611102

6. AUTHORS

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES AND ADDRESSES
Brown University
Office of Sponsored Projects
Box 1929
Providence, RI 02912 -9093

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS (ES)
U.S. Army Research Office
P.O. Box 12211
Research Triangle Park, NC 27709-2211

10. SPONSOR/MONITOR'S ACRONYM(S)
ARO

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
71256-MA-CF.1

12. DISTRIBUTION AVAILIBILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES
The views, opinions and/or findings contained in this report are those of the author(s) and should not contrued as an official Department of the Army position, policy or decision, unless so designated by other documentation.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	15. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Hongjie Dong
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RPPR Final Report
as of 11-Sep-2018

Agency Code:

Proposal Number: 71256MACF **Agreement Number: W911NF-17-1-0284**
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DUNS Number: 001785542 EIN: 050258809
Report Date: 28-Aug-2018 Date Received: 10-Sep-2018
Final Report for Period Beginning 29-May-2017 and Ending 28-May-2018
Title: Conference Proposal: "Nonlinear PDEs, Stochastic Control, and Filtering: New Methods and Applications"
Begin Performance Period: 29-May-2017 **End Performance Period:** 28-May-2018
Report Term: 0-Other
Submitted By: Hongjie Dong Email: hongjie_dong@brown.edu
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Distribution Statement: 1-Approved for public release; distribution is unlimited.

STEM Degrees: 0 **STEM Participants:** 4

Major Goals: The objective of the meeting is to revisit classical problems and explore new directions where real world problems have been and can be successfully studied by an exchange of ideas and methods from PDE, probability, and numerical analysis. Topics of the meeting where both probabilistic and analytic methods have been essential to achieve major developments in recent years include the following.
• Nonlinear PDEs of parabolic and elliptic types arising in stochastic control problems (often called Bellman equations, or Hamilton–Jacobi–Bellman equations), and in stochastic differential games (Isaacs equation). These equations play important roles also in other areas of mathematics and applied fields. Monge Ampère equation, which is a special Bellman equation, arises, for example, in solving central problems in differential geometry and in optimal transport.
• Stochastic partial differential equations arising in nonlinear filtering (Zakai equations, Kushner–Shiryaev equations), in Biology (e.g., the Fleming–Viot and Dawson–Watanabe equations), in Engineering (e.g., stochastic Navier–Stokes equations) and in Physics (e.g., the Kardar–Parisi–Zhang equation).

Accomplishments: The conference were successfully held at the International Centre for Mathematical Sciences (ICMS) on the campus of Edinburgh University, UK, on May 29th–June 2nd, 2017. Twelve participants from the US were supported by this grant.

The meeting brought together world leading researchers, who made fundamental contributions to the theory of nonlinear PDEs, probability and numerical analysis, and young scientists at different stages of their carrier. Important new directions, ideas, and methods were presented in the meeting, motivated by recent mathematical challenges arising in physics, engineering, biology, economics and finance, where bridges between different mathematical fields can be used to make a significant progress.

Training Opportunities: The lectures were interspersed with discussion sessions and poster sessions, as well as many opportunities for interaction between the participants. The participation of young researchers at an early stage of their career were encouraged. The world famous senior speakers at the meeting attracted also Ph.D. students from the US and other countries.

Results Dissemination: There were discussion sessions organized during the conference, and a summary of the conference was published on the ICMS webpage.

Honors and Awards: Nothing to Report

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as of 11-Sep-2018

Protocol Activity Status:

Technology Transfer: Nothing to Report

PARTICIPANTS:

Participant Type: PD/PI
Participant: Hongjie Hongjie
Person Months Worked: 1.00 **Funding Support:**
Project Contribution:
International Collaboration:
International Travel:
National Academy Member: N
Other Collaborators:

Participant Type: Co PD/PI
Participant: Boris Rozovsky
Person Months Worked: 1.00 **Funding Support:**
Project Contribution:
International Collaboration:
International Travel:
National Academy Member: N
Other Collaborators:

Final report

The conference were successfully held at the International Centre for Mathematical Sciences (ICMS) on the campus of Edinburgh University, UK, on May 29th–June 2nd, 2017. Twelve participants from the US were supported by this grant.

This conference was organized on the occasion of Professor Nicolai V. Krylov's seventy-fifth birthday. Nicolai V. Krylov for decades has made fundamental contribution in PDEs, stochastic controls, and filtering, and has been influential in many areas of pure and applied mathematics.

The objective of the meeting was to revisit classical problems and explore new directions where real world problems have been and can be successfully studied by an exchange of ideas and methods from of PDE, probability, and numerical analysis. Topics of the meeting where both probabilistic and analytic methods have been essential to achieve major developments in recent years include the following. (1) Nonlinear PDEs of parabolic and elliptic types arising in stochastic control problems (often called Bellman equations, or Hamilton–Jacobi–Bellman equations), and in stochastic differential games (Isaacs equation). These equations play important roles also in other areas of mathematics and applied fields. Monge Ampère equation, which is a special Bellman equation, arises, for example, in differential geometry and in optimal transport. (2) Stochastic partial differential equations arising in nonlinear filtering (Zakai equations, Kushner–Shiryaev equations), in Biology (e.g., the Fleming–Viot and Dawson–Watanabe equations), in Engineering (e.g., stochastic Navier–Stokes equations) and in Physics (e.g., the Kardar–Parisi–Zhang equation).

The meeting brought together world leading researchers, who made fundamental contributions to the theory of nonlinear PDEs, probability and numerical analysis, and young scientists at different stages of their carrier. The interplay between nonlinear PDEs, stochastic and numerical analysis was extremely fruitful in the development of these areas. Important new directions, ideas, and methods were presented in the meeting, motivated by recent mathematical challenges arising in physics, engineering, biology, economics and finance, where bridges between different mathematical fields can be used to make a significant progress. There were about 40-50 participants, 34 speakers (8 plenary lectures, 1 public lecture, 1 industry lecture, 22 talks from experts, several short communications by young researchers). The list of speakers includes Robert Dalang, Hongjie Dong, Vladimir Bogachev, Zdzislaw Brzezniak, Doyoon Kim, Kijung Lee, Alexander Veretennikov, László Gerencsér, Michael Röckner, Sergei Kuksin, Giuseppe Da Prato, Annie Millet, Mariano Giaquinta, Máté Gerencsér, Erika Hausenblas, Terry Lyons (public lecture), David Elworthy, Camelia Pop, Mark Freidlin, Etienne Pardoux, Kyeong-Hun Kim, Alexander Wentzell, Dan Crisan, Tadahiro Oh, Arnulf Jentzen, Alexander Davie, Max Jensen, Franco Flandoli, Felix Otto, and Seick Kim. These lectures were interspersed with discussion sessions and poster sessions, as well as many opportunities for interaction between the participants.

The research topics represented by the speakers were aligned and support the research goals of the Army. More specifically, Stochastic Partial Differential Equations (3.2.1.a), Measure-Valued Stochastic Processes (3.2.1.b), Weakly Interacting Stochastic Systems and Mean-Fields Control and Game Theory (3.2.1.c), and Other Areas that Require Stochastic Analytical Tools (3.2.1.e) such as stochastic fluid dynamics and turbulence.