Scientific Report

First name / Family name	Miłosz Krupski
Nationality	Polish
Name of the *Host Organisation*	NTNU
First Name / family name of the *Scientific Coordinator*	Espen R. Jakobsen
Period of the fellowship	01/02/2019 to 31/01/2021

I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

During the fellowship, most of my scientific research was focused on the study of the so-called mean field games.

With my collaborators, Espen R. Jakobsen and Indranil Chowdhury, we proposed a new model, based on the mean field game theory introduced by Lasry and Lions, and Huang, Caines and Malhamé.

In contrast to the more classical setting, our problem does not involve control of the drift but rather the diffusion, or more specifically, the time change rate of a Lévy process. The resulting system of fully nonlinear partial differential equations may be local or nonlocal, and sometimes degenerate.

We prove existence and uniqueness of solutions of a class of abstract fully nonlinear mean field game systems involving local or nonlocal diffusions. We justify that such problems are related to controlled diffusions, or more specifically, controlled time change rates of stochastic (Lévy) processes. Both the system of equations and the precise control interpretation seem to be new. The results apply for degenerate equations of low order, and some nondegenerate equations.

In the spring semester of academic year 2019/2020, I taught Fourier Analysis course.

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

[1] **Karch, Grzegorz**; **Kassmann, Moritz**; **Krupski, Miłosz**. A framework for nonlocal, nonlinear initial value problems. *SIAM J. Math. Anal.* **52** (2020), no. 3, 2383--2410.

[2] **Chowdhury, Indranil**; **Jakobsen, Espen R.**; **Krupski, Miłosz**. Existence and uniqueness for fully nonlinear mean field games with examples of nonlocal or local diffusion *in preparation.*

III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

1. May 2019 – Norwegian meeting on PDEs, Trondheim (poster).
2. June 2019 – XI Forum of Partial Differential Equations, Będlewo (short talk).
3. July 2019 – EMS Summer School, Milan.
4. December 2019 – Seminar talk at University of Wrocław
5. January 2020 – V Congreso de Jóvenes Investigadores, Castelló de la Plana (short talk).
6. June 2020 – Seminar talk at NTNU
7. January 2021 – Seminar talk at NTNU

IV – RESEARCH EXCHANGE PROGRAMME (REP)

Due to the COVID-19 pandemic, I was unable to travel to undertake research exchange. I held some preliminary scientific discussions in July and December 2019, and January 2020 with dr Iwona Chlebicka from University of Warsaw. This work will hopefully continue outside the Fellowship framework.