



**UNIVERSITY OF
STIRLING**

SCHOOL OF
NATURAL SCIENCES

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**Computing Science and Mathematics
Dr Savitri Maharaj
Lecturer**

Telephone: 01786 467431

Facsimile: 01786 464551

Email: savi@cs.stir.ac.uk

The Dean
Prof. dr hab Andrzej Warczak,
Faculty of Physics, Astronomy and Applied Computer Science,
Jagiellonian University,
Ul. Reymonta 4,
PL-30-059 Kraków,
Poland

Dear Prof. Warczak,

This is a report on the thesis entitled "Searching for optimal control strategy of epidemics spreading on different types of networks", submitted by Mrs Katarzyna Oleś, candidate for the degree of Doctor of Philosophy.

The thesis presents a detailed study of spatially-sensitive strategies for controlling the spread of infectious disease epidemics on a range of different social contact networks. The study considers the social and economic costs of preventative strategies such as vaccination or culling (for plant or animal diseases) as well as the costs of treatment or mortality from the disease. The network structures examined include square lattices, small world networks, and clustered random networks. As this is a thesis by publication, the work is presented in the form of four published journal papers accompanied by an overview document which gives a literature review and a general overview of the methods and results. The student is named as first author on three papers and as second author on one. All four papers have been published in prestigious peer-reviewed journals.

The literature review is brief but is sufficient to demonstrate that the student has a good understanding of the broader context of the work and the types of disease for which the study can be applied. The overview shows clearly that the papers form a coherent, progressive sequence of inter-related studies on the same topic. Taken together, these papers constitute a significant, original contribution to the study of epidemics on networks. The strongest contribution is in paper 1, which introduces a new model of epidemic control on networks and studies it thoroughly. This study is continued in papers 2 and 3 which look in more detail at some aspects of the model. Paper 4 extends the model by considering a different class of network, namely, clustered random graphs.

The work presented shows that the student has mastered a variety of research techniques for studying epidemic spread, including individual-based stochastic simulation, mean-field methods, and the use of networks. The work is presented clearly and comprehensibly, and there is appropriate discussion of the limitations of the study and the possibilities for future work. I do have some questions about the network definitions and algorithms that were used, particularly in paper 4, which I will raise at the defense. The questions do not concern any errors in the work, but rather details that I would like the student to describe more fully.

In my opinion, the presented material fulfills the formal and meritoric criteria required by Polish regulations for completion of the PhD process. On this basis I agree that the procedure of opening the Polish "public defense" for Mrs Katarzyna Oleś will be granted.

Yours sincerely,