



**DGS II 2013 - International Conference and  
Advanced School Planet Earth  
Dynamics, Games and Science II**

28 August to 6 September 2013

**Calouste Gulbenkian Foundation (FCG) and  
Instituto Superior de Economia e Gestão, Universidade Técnica de  
Lisboa (ISEG-UTL)**

**Lisboa, Portugal**

**Keynote Speakers and school lecturers**

Elvio Accinelli, UASLP, Mexico Michel Benaïm, Université de Neuchâtel, Switzerland

Fabio Chalub, Universidade Nova de Lisboa, Portugal

Jim Cushing, University of Arizona, USA

João Lopes Dias, Universidade Técnica de Lisboa, Portugal

Pedro Duarte, Universidade de Lisboa, Portugal

Marta Faias, Universidade Nova de Lisboa, Portugal

Lorens Imhof, University of Bonn, Germany

Yunping Jiang, City University of New York, USA

José Martins, I.P. Leiria, Portugal

Bruno Oliveira, Universidade do Porto, Portugal

Jorge Pacheco, Universidade do Minho, Portugal

Joana Pais, ISEG/Technical University of Lisbon, Portugal

Alberto A. Pinto Universidade do Porto, Portugal

Martin Shubik, Yale University, USA )

Renato Soeiro, Universidade do Porto, Portugal

Satoru Takahashi, National University of Singapore

Jorge Zubelli, IMPA, Brasil

Organized by The International Center of Mathematics CIM - Portugal



data and the locations where the species is known to be present, to forecast the probability of infestation.

We have also constructed a model of the spread of the infestation in the particular urban environment of Angra do Heroísmo, Azores, using an agent based modeling approach. The model was built in steps of increasing complexity taking into account the ecology of the species and with a continuous cross-checking of the results obtained with the field data. We have also introduced different control strategies and evaluated their costs.

We find that, in general, the probability of occurrence is higher near the coast line, where the majority of the towns and villages are located so that infestation has potential to spread to yet unaffected towns and islands.

Our model of the spread of the infestation predicts a region of infestation that is similar to the known map of infestation. The model predicts that virtually no houses inside the infested region can remain uninfested, even when the probability of infestation is relatively low, and this is indeed what is observed in the field. Some preliminary results suggest that coordination of the pest control agents is important to provide a solution to the problem.

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## Dynamics, Modelling and Optimisation

Organizer: *João Paulo Almeida*

Instituto Politécnico de Bragança

September 2nd, 14:15-15:15 and 15:30-16:30, Sala 1

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## Solving Flexible Job Shop Scheduling using Genetic Algorithm

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This work addresses a real assembly cell: the AIP-PRIMECA cell at the Université de Valenciennes et du Hainaut-Cambrésis, in France. This system can be viewed as a Flexible Job Shop, leading to the formulation of a Flexible Job Shop Scheduling Problem (FJSSP). This FJSSP offers the possibility to create the products "AIP", "LATE" and "BELT" using by five workstations, each one being able to perform a set of operations, that are linked using a conveyor system. The transportation between stations is achieved using a shuttle which is able to transport one product at the time, being released after the product processing conclusion.

The problem consists in finding a operations schedule on the machines, taking into account the precedence constraints minimizing the batch makespan, i.e., the finish time of the last operation completed in the schedule.

To solve the flexible job shop the genetic algorithm (GA) was used to obtain the global solution. As opposed to many other optimization methods, genetic algorithm works with a population of solutions instead of one single solution. In the GA the solutions are combined to obtain new solutions until obtain a satisfactory solution. The genetic algorithm is a stochastic method, whose mechanism is based on the simplifications of evolutionary process observed in nature: crossover, mutation and selection.

[1] N. Al-Hinai, T. ElMekawy, Solving the Flexible Job Shop Scheduling Problem with Uniform Processing Time Uncertainty, *World Academy of Science, Engineering and Technology* 64, pp. 996-1001, 2012.

[2] M. Kumar, M. Husian, N. Upreti, D. Gupta, Genetic Algorithm: Review and Application, *International Journal of Information Technology and Knowledge Management*, 2(2), pp. 451-454, 2010.

[3] C. Pach, A. Bekrar, T. Bonte, Y. Sallez, T. Berger, D. Trentesaux, P. Leitão and J. Barbosa, Benchmarking flexible job-shop scheduling and control systems, *Control Engineering Practice* 21, pp. 1204-1225, 2013.