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## Foreword

Fire and its control is one of the facts that most influenced on the evolution of humankind. Platon already linked the first element, the Fire, to the simplest regular polyhedron, the tetrahedron. For its simple shape and with one of its vertex up, it looks like very similar to a flame. With reason Galileo said that *Nature's great book is written in mathematical language*.

Understanding the fire dynamics is not possible without the collaboration of multidisciplinary studies with the most advanced methods on Chemistry, Engineering, Physics, Material Science, Mathematics, Computing Science, together with other sciences (depending on the application of the theories) like Geography, Environmental Sciences, Architecture, etc.

In the background of these studies, it is necessary to develop new mathematical, both analytical and numerical models and methods for solving them, data acquirement, which involve the use of Statistics, Operation Research, and almost every branch of Applied Mathematics.

The international Workshop on “*Mathematics and Fire*” was organized and held in Zaragoza at the Instituto Universitario de Matemáticas y Aplicaciones (IUMA) from 15th–17th June 2009 (see Figures 1 and 2). Scientists from several fields, Mathematics, Physics, Engineering, Environment Administration, etc, took part in this conference, addressing scientific problems related with fire from clearly complementary approaches, seeking to gain and learn from this dual approach and proposing closer collaboration in the near future.

This Congress was also partially supported with funds from Ministry of Education and Science, from the Aragón Government —from the Science Department and also from Direction of Control of Forest Fires—, whose Director, Alberto Contreras, enthusiastically supported the topic of the congress; let us remark that most of Aragón is located in a very dry area where fires are costly to control and that every year uncontrolled fires cause very important natural and economic losses. We also like to thank to the mentioned Direction of Control of Forest Fires for the exhibition in our Faculty of Science, showing how firefighters work to prevent and to extinguish fires in Nature.

The Scientific Committee was formed by Antonio Elipe, IUMA, Univ. Zaragoza, Spain; Amable Liñán (Chair), Univ. Politécnica de Madrid, Spain and Ronald Rehm, NIST, USA. The Organizing Committee was in charge of Luis Rández, Manuel Alfaro and Pilar Laburta (the three from the IUMA, Univ. Zaragoza). The success of the

conference was possible thanks to a great joint effort.

There was a total of 51 participants, and 14 invited lectures, in which different aspects of the relation between Mathematics and fire were analyzed. We had time to share our views on the topic, with vivid discussions and some collaborations were planned for the next future.

The editors would like to thank José Ramón Beltrán, Vicerrector of Research of the University Zaragoza; José Luis Serrano, Director of Research of the Aragón Government; Alberto Contreras, Director of Control of Forest Fires of the Aragón Government, and Ana Elduque, Dean of the Faculty of Science, who showed their support during the opening Session. Thanks are also due to the Real Academia de Ciencias de Zaragoza for including the Proceedings of this Workshop as a volume of its Monograph Series.

The Editors

Antonio ELIPE

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Luis RÁNDEZ

# Maths & Fire

Zaragoza, June 15-17, 2009

Instituto Universitario de Matemáticas y Aplicaciones



Universidad de Zaragoza

## Scientific Committee

**Antonio Elipe, IUMA, Univ. Zaragoza**  
**Amable Liñán, Univ. Politécnica Madrid**  
**Ronald Rehm, US NIST**

## Main Speakers

**Alfredo Bermúdez de Castro, Univ. de Santiago**  
**Rodolfo Bermejo, Univ. Politécnica Madrid**  
**José Durany, Univ. de Vigo**  
**Luis Ferragut, Univ. de Salamanca**  
**Keisuke Himoto, Kyoto Univ. Pioneering Research, Japan**  
**William P. Jones, Imperial College London**  
**Amable Liñán, Univ. Politécnica Madrid**  
**Ronald Rehm, US NIST**  
**Luis Valiño, LITEC, CSIC, Zaragoza**  
**Santiago de Vicente, Univ. Politécnica Madrid**

## Organizing Committee

**Luis Ránde**  
**Manuel Alfaro**  
**Pilar Laburta**

$$\begin{aligned}\frac{dT}{dt} &= \nabla \cdot (k \nabla T) + \vec{v} \cdot \nabla T + A(S_r(T) - C_0(T - T_0)), \\ \frac{dS}{dt} &= -C_s S_r(T)\end{aligned}$$

[http://iuma.unizares/maths\\_fire/](http://iuma.unizares/maths_fire/)



Patrocina:





View of participants