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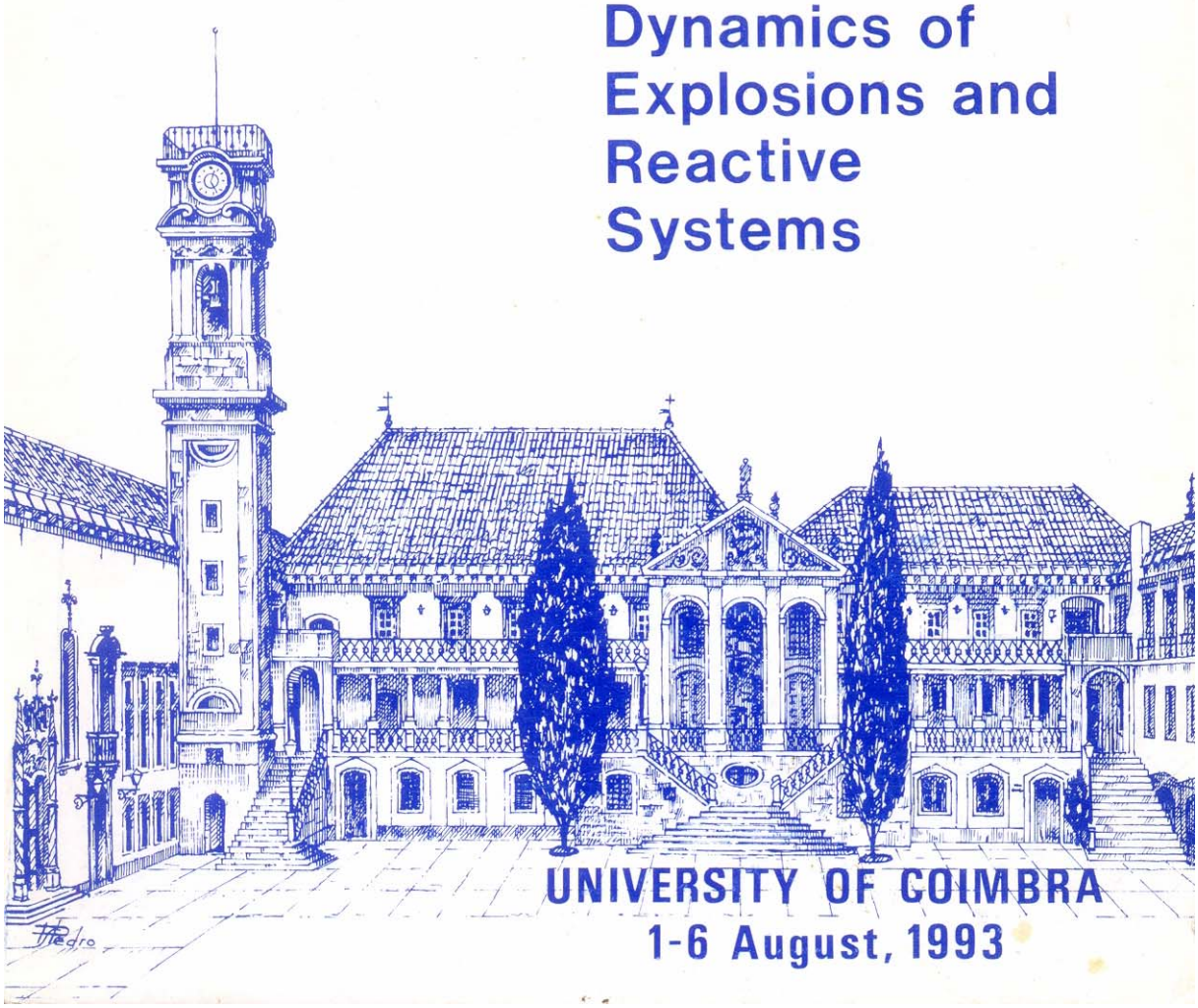

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A Study of Explosion Onset in a Non-uniformly Preheated H_2/O_2 Mixture

S.M. Frolov
Semenov Institute, Russian Academy of Science, Moscow, Russia

A. Mack and P. Roth
Institut für Verbrennung und Gasdynamik
Universität Duisburg, 47048 Duisburg, Germany

A detailed study of spontaneous explosion onset in a non–uniformly preheated H_2/O_2 mixture close to self-ignition conditions is presented. The corresponding conservation equations were solved numerically using an adaptive moving grid technique to capture the different combustion and pressure waves. The mathematical model includes a multi-component transport model and a detailed reaction mechanism.

Various combustion regimes ranging from spatially uniform constant volume explosions to oscillatory explosion processes were observed depending on the structure of the temperature non–uniformity. Special emphasis was put on the question how a spontaneous flame can evolve to a detonation wave. The numerical results show that a simple coupling criterion can be used to estimate conditions under which a direct detonation initiation occurs. The threshold values of the non–uniformly distributed internal energy which are required for a direct detonation initiation, are 2 to 3 orders of magnitude less than the characteristic critical energy of blast detonation initiation.