# PURE AND APPLIED MATHEMATICS

## Models of highly energetic materials

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| **Funded By** | Dipartimento DISMA<br>FONDAZIONE CRT CASSA DI RISPARMIO DI TORINO<br>[P.iva/CF:06655250014] |
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| **Context of the research activity** | An interdisciplinary study involving thermodynamics, statistical mechanics, fluid dynamics and numerical analysis to understand and predict the behaviour of highly energetic materials. The first purpose of this project is the development of mathematical models of transport of energy and matter under extreme conditions of pressure and temperature, which are known to lead to non-linear and anomalous transport phenomena and implement these models in a simulation code. |
| **Objectives** | An interdisciplinary study involving thermodynamics, statistical mechanics, fluid dynamics and numerical analysis is proposed to understand and predict the behaviour of highly energetic materials [1]. The first purpose of this project is the development of mathematical models of transport of energy and matter under extreme conditions of pressure and temperature, which are known to lead to non-linear and anomalous transport phenomena [2,3]. This is meant to yield a deeper understanding of the thermodynamics of highly energetic materials, acquiring predictive ability on their performance under different conditions, using and developing the theory of The Jones-Wilkins-Lee equation of state [4]. Then, suitable numerical software [5] will be developed to simulate the corresponding evolution equations, so that quantitative predictions be obtained. The software, in particular, will estimate the specific properties concerning the performance of highly energetic materials, such as speed, pressure waves, thermodynamics of reaction products, etc. |


1. Zel'dovich, Ya B and Raizer Yu P (1966) Physics of Shock Waves and High-Temperature Hydrodynamic Phenomena, Volumes I and II, Academic Press, London.
2. Barenblatt, G (2003). Scaling, Cambridge Texts in Applied Mathematics, Cambridge University Press, Cambridge.
3. Rondoni, L (2021) Introduction to Nonequilibrium Statistical Physics and Its Foundations, In Xiang-Yang Liu, Singapore, Springer Nature, 1-82
4. Baudin G and Serradeill, R (2010) Review of Jones-Wilkins-Lee equation of state, EPJ Web of Conferences Vol.10, 00021

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| | 5. Mader, C L (2008) Numerical Modeling of Explosives and Propellants, CRC Press, Boca Raton |

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| **Skills and competencies for the development of the activity** | Kinetic theory and statistical mechanics;<br>Fluid mechanics;<br>Numerical methods;<br>Modern programming language. |