PROCESS, PLANT AND MACHINE SAFETY

SAFETY @ STEMS

CHEMICAL SAFETY

MACHINERY SAFETY

RISK ASSESSMENT

SAFETY @ STEMS

CHEMICAL SAFETY

Risk prevention and mitigation associated with

- Explosions
- Fires
- Release of toxic substances

MACHINERY SAFETY

Need to guarantee

- Performance functional to safety for the operator
- Reliability

… in a context more difficult

- ✓ Smart/autonomous robots and systems
- ✓ Higher complexity of electronic control systems (especially in new electrified vehicles)
- ✓ More stringent requirements with respect to noise and vibrations

RISK ASSESSMENT

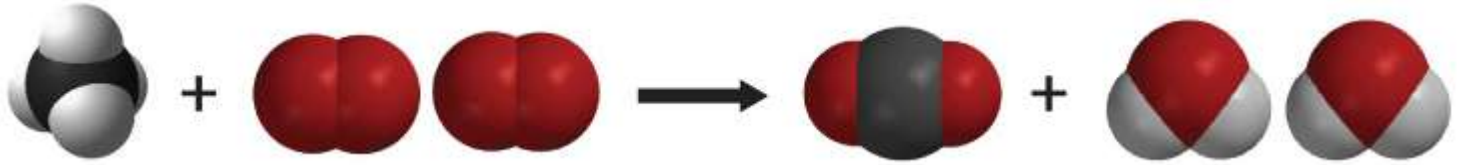
Reduction of forest fire risk

- ✓ Extreme climatic conditions (drought)
- ✓ Forest fires also close to urban / industrial areas

PROCESS, PLANT AND MACHINE SAFETY

Development of prototypes and experimental protocols and methodologies and predictive mathematical models for the analysis, prevention and mitigation of risks associated with accidental phenomena, such as explosions, fires and the release of toxic substances

from "***FUNDAMENTALS***" …

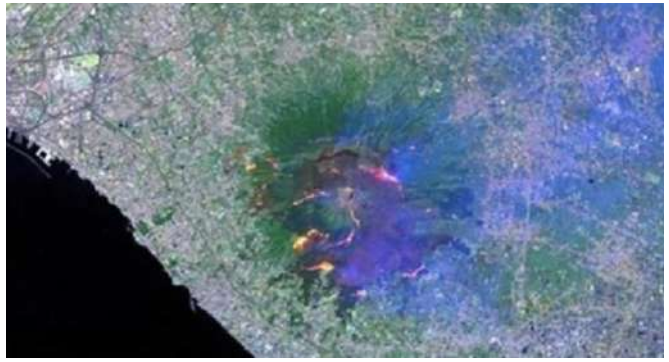


CH_4 + $2\ O_2$ → CO_2 + $2\ H_2O$

Chemical reaction → Turbulence → Interaction Flame / Flow Field / Geometry

Laboratoty Scale → Pilot Scale → Industrial Scale → Landscape Scale

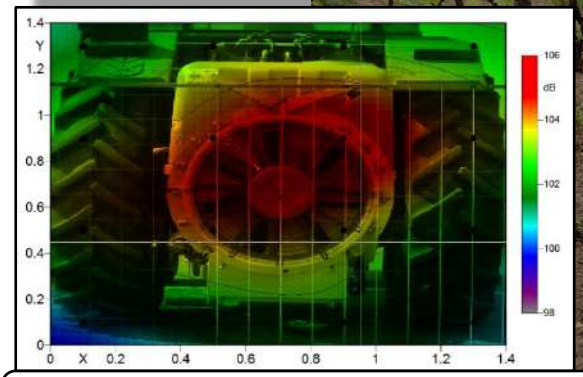
… to "***REAL SCALE***"

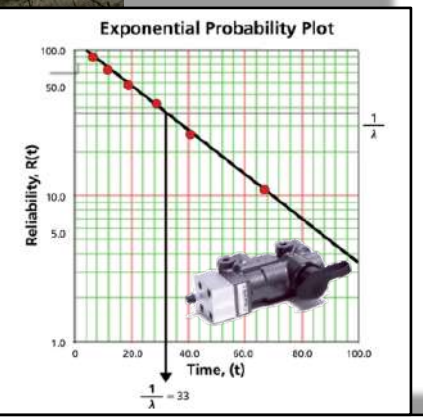


PROCESS, PLANT AND MACHINE SAFETY

Develop protocols and best practices for safety in robotics, with particular attention to collaborative robotics and driving or other autonomous functions

Promote safety-driven development in the control of machines and processes





Reduce risks and improve comfort by limiting acoustic and vibrational emissions from machinery, vehicles and their components

Develop predictive methodologies on an experimental basis for the quantification of reliability parameters and response to fault conditions

PROCESS, PLANT AND MACHINE SAFETY

CHEMICAL SAFETY

- Experimental characterization (under process conditions)
- Computational Fluid Dynamics (CFD) - 3D models based on LES and URANS approaches
- Detailed kinetic modeling
- Development of predictive models for shelf-life
- Stability and biforcational analysis through multi-scale methods for complex systems

MACHINERY SAFETY

- Analysis, verification and validation of systems according to functional safety standards
- Model-based development of algorithms of control
- Statistical calculation and prediction of the reliability parameters (MTTF, B10, etc.) of the components
- System performance calculation
- Psychoacoustics for product sound quality
- Measurement and containment of acoustic and vibrational emissions

RISK ASSESSMENT

- Methods of analysis and risk reduction through optimization methods based on the theory of complex networks
- Methods based on artificial intelligence and data mining methods to identify the critical conditions for catastrophic transitions in complex systems

PROCESS, PLANT AND MACHINE SAFETY

CHEMICAL SAFETY

- ✓ Flammability and Explosive behavior of gases / vapors, dusts and hybrid systems (dust-gases / vapors)
- ✓ Propagation and extinguishing of industrial fires
- ✓ Fire response of materials
- ✓ Loss of control of chemical systems - Runaway phenomena
- ✓ Aging of energetic materials (explosives and propellants)
- ✓ Instability of chemical processes
- ✓ Industrial toxicology

MACHINERY SAFETY

- ✓ Control strategies and systems for functional safety
- ✓ Acoustic and vibrational emissions
- ✓ Transposition and application of safety regulations

RISK ASSESSMENT

- ✓ Development of real-time simulators for the control and management of the propagation of forest fires
- ✓ Development of methodologies for the optimal placement of fuel breaks for the reduction of forest fire risk

PROCESS, PLANT AND MACHINE SAFETY

PROGETTI EU

- Prediction Models for the Implementation of Munition Health Management (*PREMIUM*) - European Defence Agency (EDA), 2021-2025
- Stand-off Detection of Hybrid Threats Containing Explosives (*STYX*) - European Defence Agency (EDA), 2021-2025
- Being Safe around Collaborative and Versatile Robots in Shared Spaces (*COVR*) - Horizon 2020, 2018-2021
- Cost Effective Robots for Smart Precision Spraying (*SCORPION*) - Horizon 2020, 2021-2023

PROCESS, PLANT AND MACHINE SAFETY

AZIENDE

Fike
FIKE EUROPE

clean energy ahead
TURBODEN
a group company of MITSUBISHI

SOLVAY

eni

NOVARTIS

Avio Aero
A GE Aviation Business

SILVATEAM

CNH INDUSTRIAL

DSM

icimen due

deimos SPACE

SAFIM
Member of DEXKO GLOBAL

TEYME
TECNOLOGÍA AGRÍCOLA, S.L.

PROCESS, PLANT AND MACHINE SAFETY

ISTITUZIONI

- Institute for Systems and Computer Engineering, Technology and Science (INESC TEC) (Portogallo)
- EURECAT - Technology Centre of Catalonia (Spagna)
- Loughborough University (Regno Unito)
- Laboratoire Réactions et Génie des Procédés (LRGP), Université de Lorraine, CNRS (Francia)
- Laboratoire de Recherche PRISME, Université d'Orléans, INSA Centre Val de Loire (Francia)
- French Alternative Energies and Atomic Energy Commission (CEA) (Francia)
- Roessingh Research and Development (RRD) (Paesi Bassi)
- Netherlands Organisation for Applied Scientific Research (TNO) (Paesi Bassi)
- Karlsruhe Institute of Technology (KIT) (Germania)
- Fraunhofer-Gesellschaft (Germania)
- Danish Technological Institute (DTI) (Danimarca)
- Swedish Defence Research Agency (FOI) (Svezia)
- Warsaw University of Technology (WUT) (Polonia)
- Polish Military Institute of Armament Technology (MIAT) (Polonia)
- Polish Military University of Technology (MUT) (Polonia)
- Ministry of Rural Development and Food (Grecia)