Assessment of fracture properties through Wedge Splitting Test and Inverse Analysis.

Ilias Psilakis & Vladimir Buljak

University of Belgrade
Faculty of Mechanical Engineering

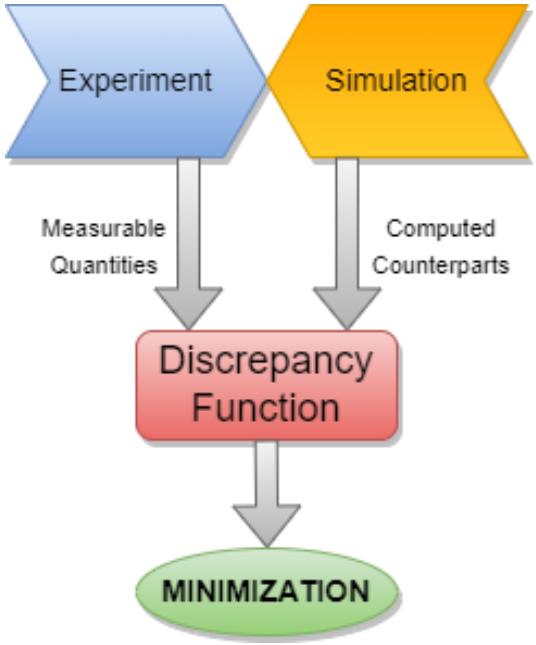
This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 955944 - RE-FRACTURE2.

RE-FRACTURE2 ITN EID PROJECT
MARIE CURIE ACTIONS

Intro & contents

- Inverse Analysis
- Wedge Splitting Test
- Numerical Simulation
- Basic sensitivity-parametric analysis
- Minimization of objective function
- Results

Inverse Analysis procedure



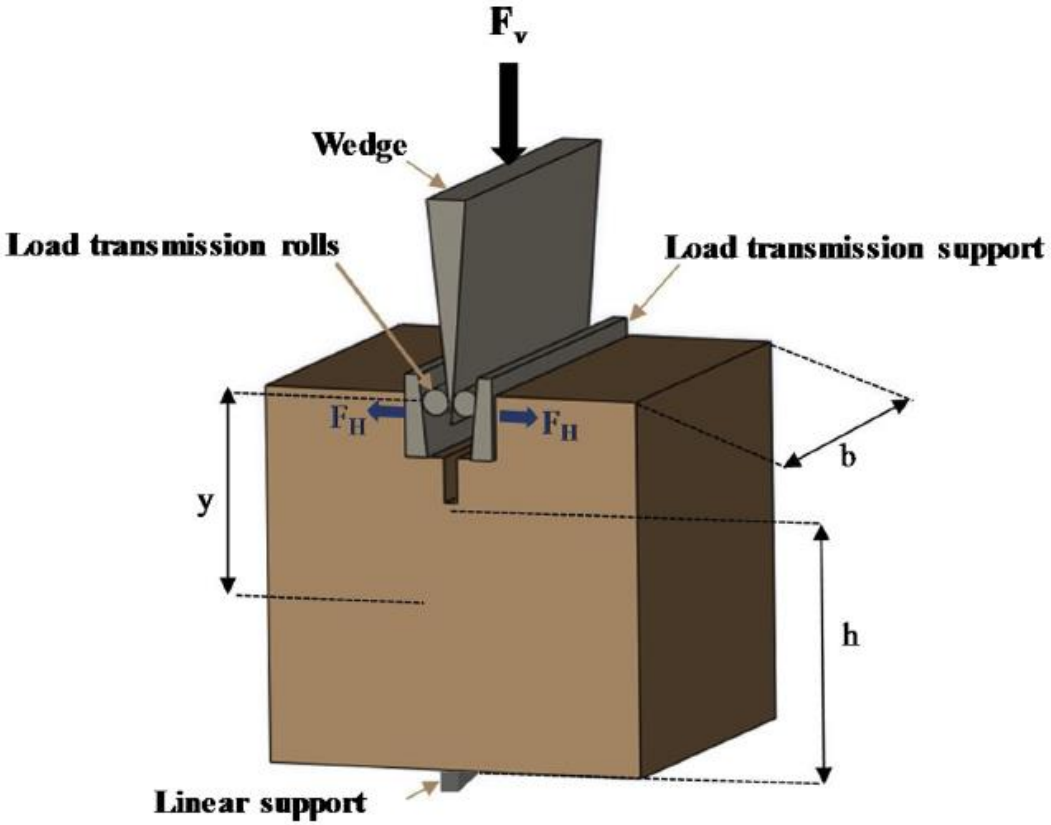
Parameters identification
(experiment selection)

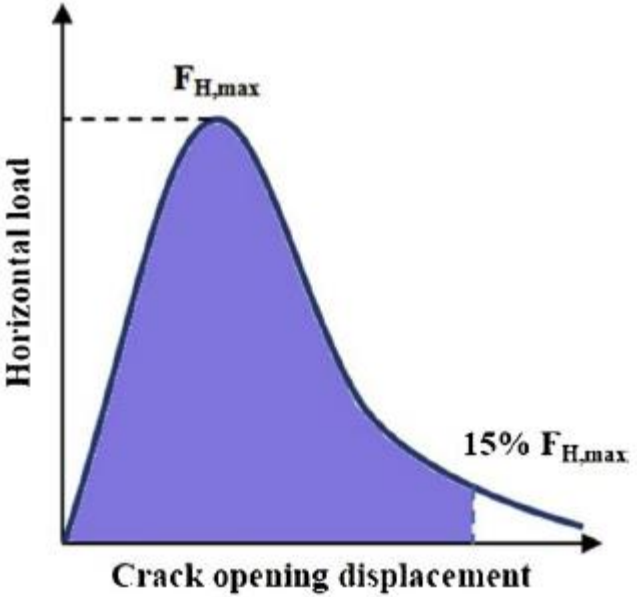
Numerical model
(FEM simulation)

Sensitivity analysis
(measurable quantities – variation of parameters)

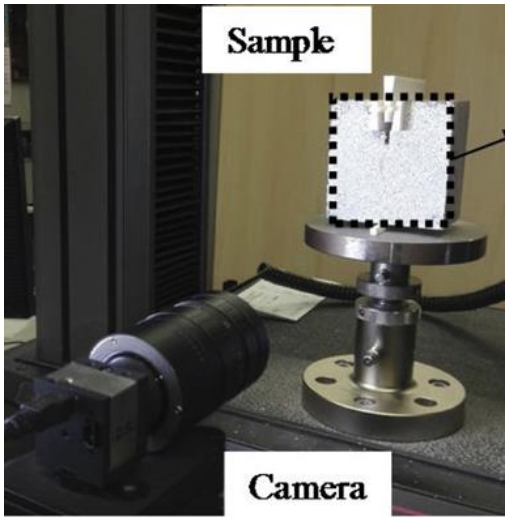
Objective function → Minimization

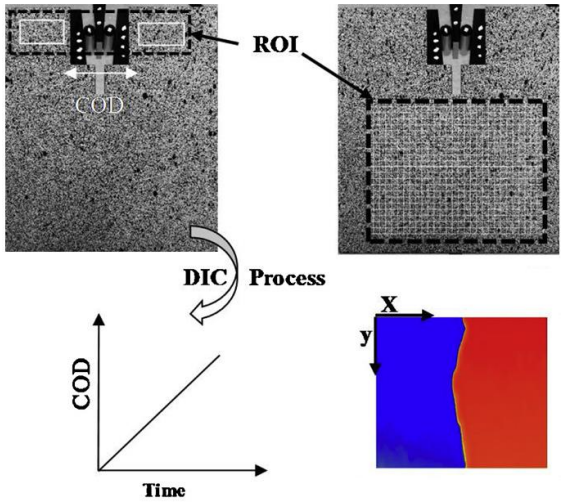
Wedge Splitting Test – experimental configuration

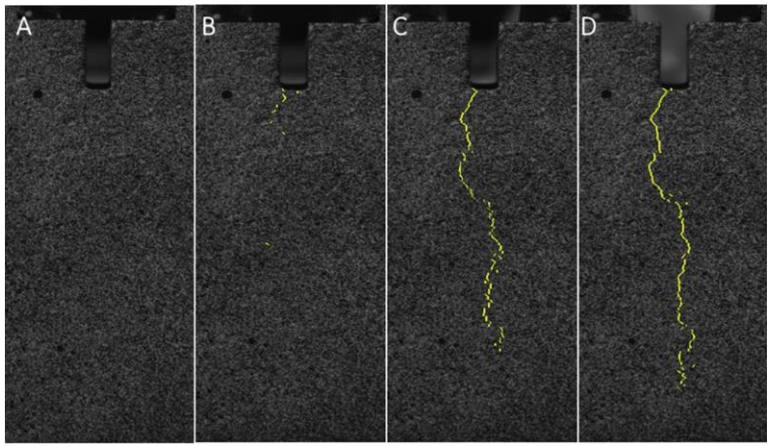




Digital Image Correlation measurements







ELSEVIER

Journal of the European Ceramic Society

journal homepage: www.elsevier.com/locate/jeurceramsoc

Original Article

Investigation of microstructure-property relantionships of magnesia-hercynite refractory composites by a refined digital image correlation technique

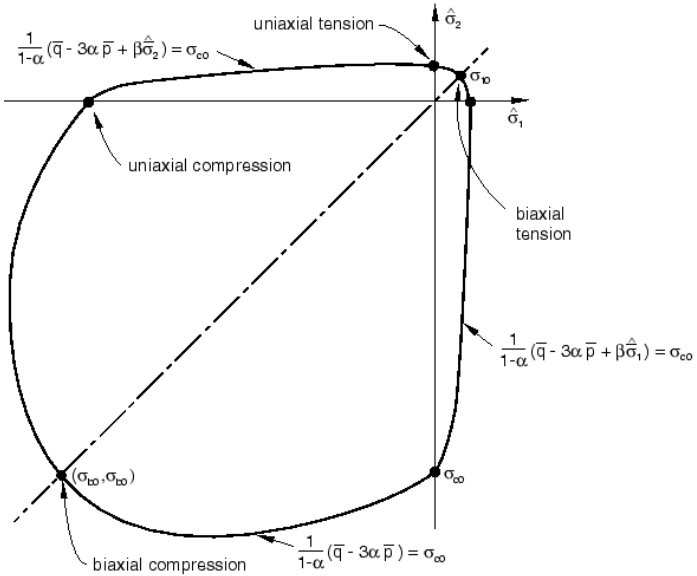
Imad Khlifi[a,*], Octavian Pop[b], Jean-Christophe Dupré[c], Pascal Doumalin[c], Marc Huger[a]

$$G_f = \frac{1}{A}\int_0^{\delta_{H\,max}} F_H .\, d\delta_H$$

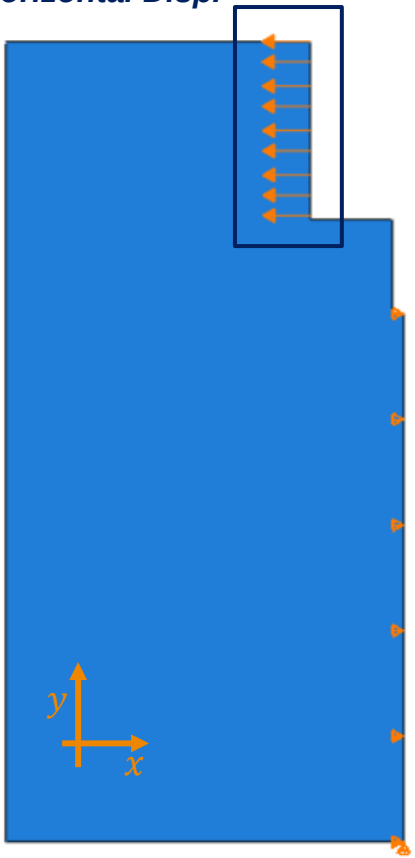
FE Model

Elasto – Plastic Model

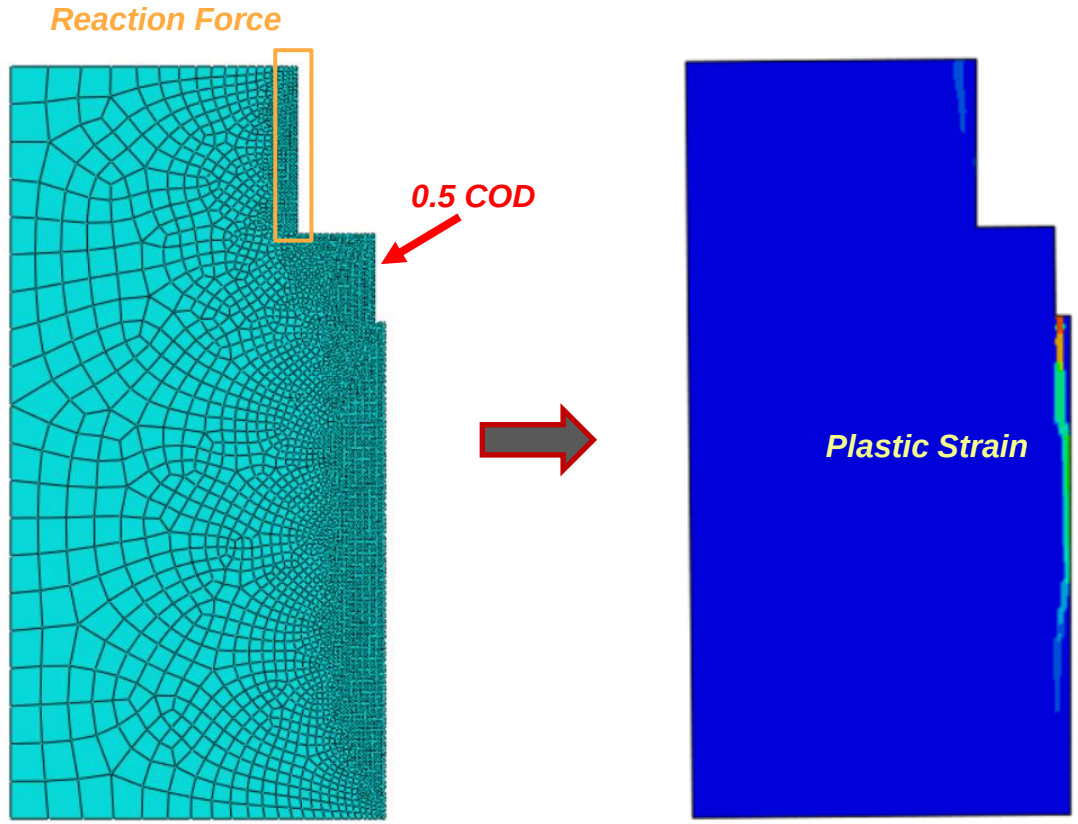
Yield function of Lubliner et. al. (1989), with the modifications proposed by Lee and Fenves (1998)



Horizontal Disp.

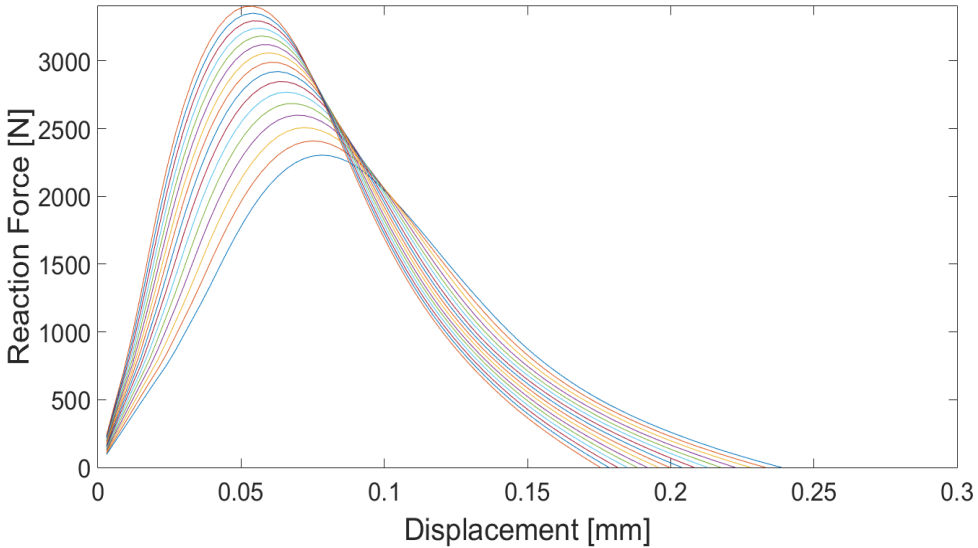


FE Model

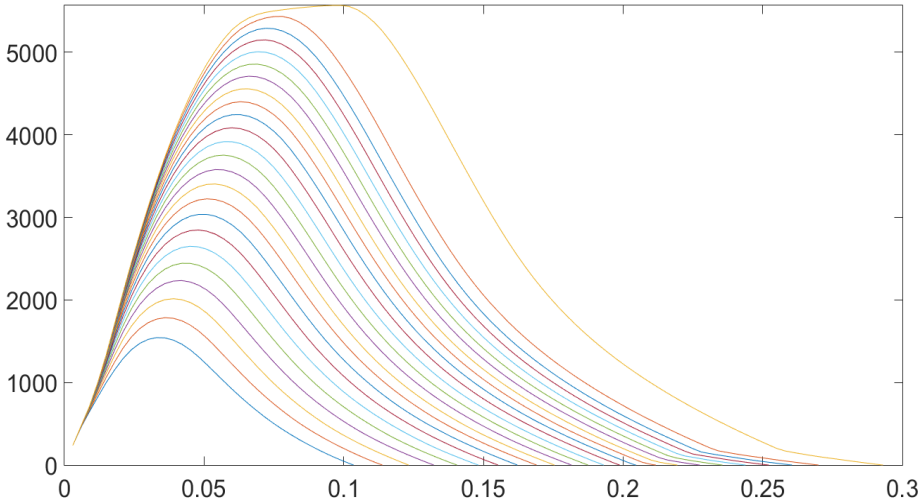


Sensitivity – parametric analysis

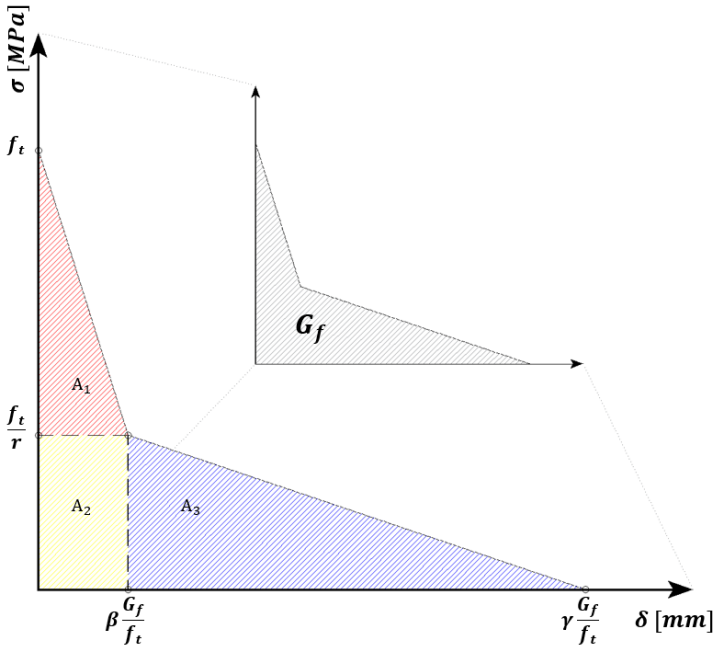
Changing Young Modulus E

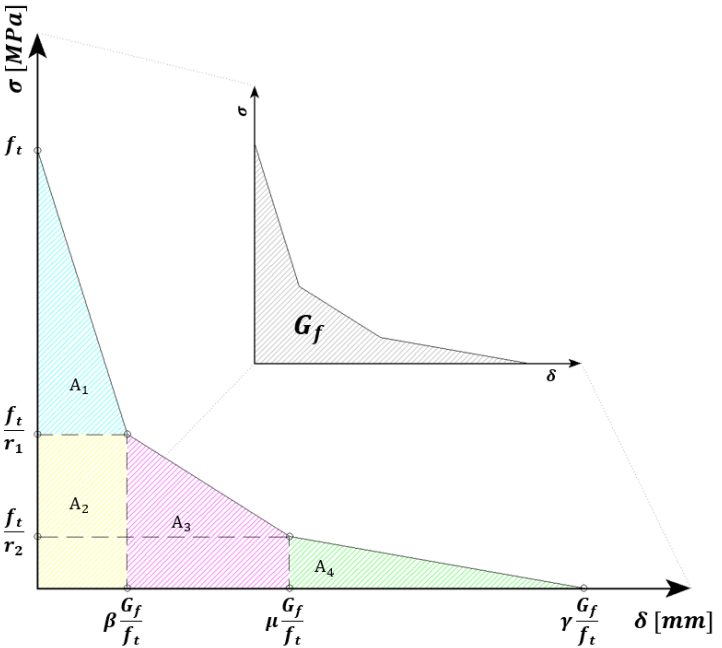


Changing the ultimate tensile strength f_t



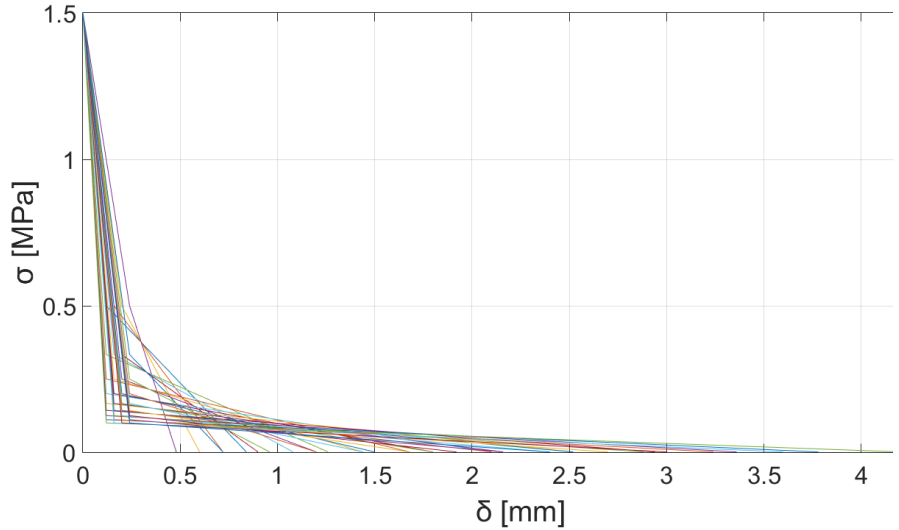
Softening Curve parametrization

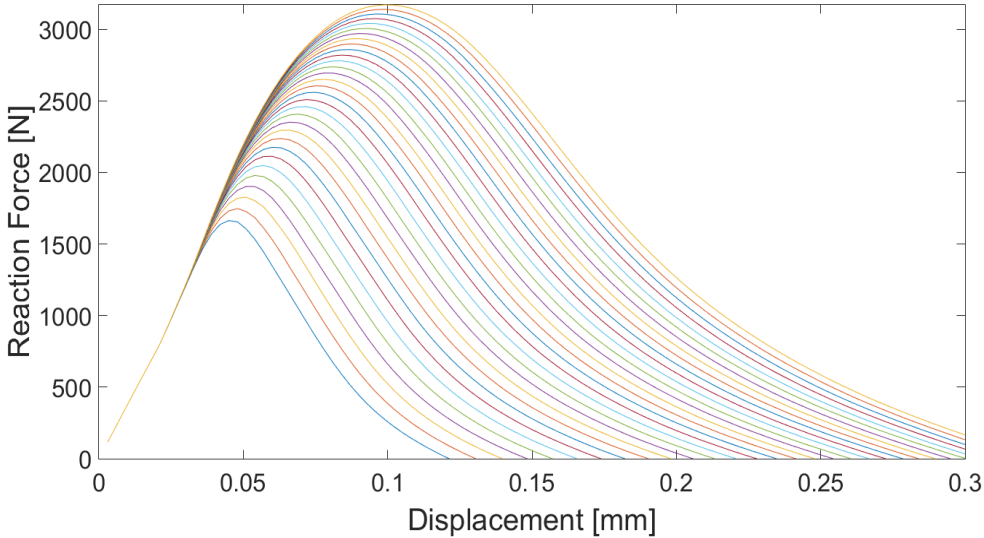


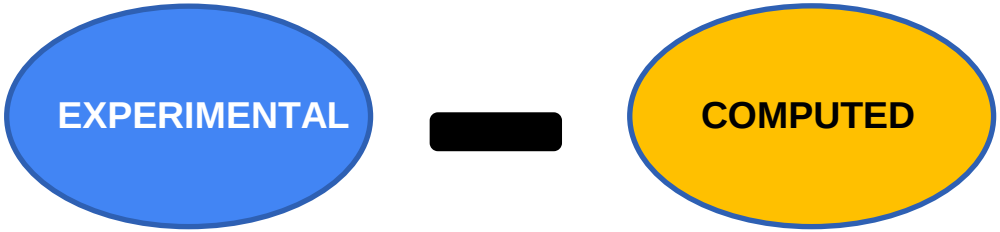


Sensitivity – parametric analysis

Changing the softening curve







Discrepancy Function $\omega = f\,|U_{exp} - U_{com}(x)| = f\,|r|$

Objective Function $f(x) = \frac{1}{2}\sum_{i=1}^{m} r_j^2(x)$

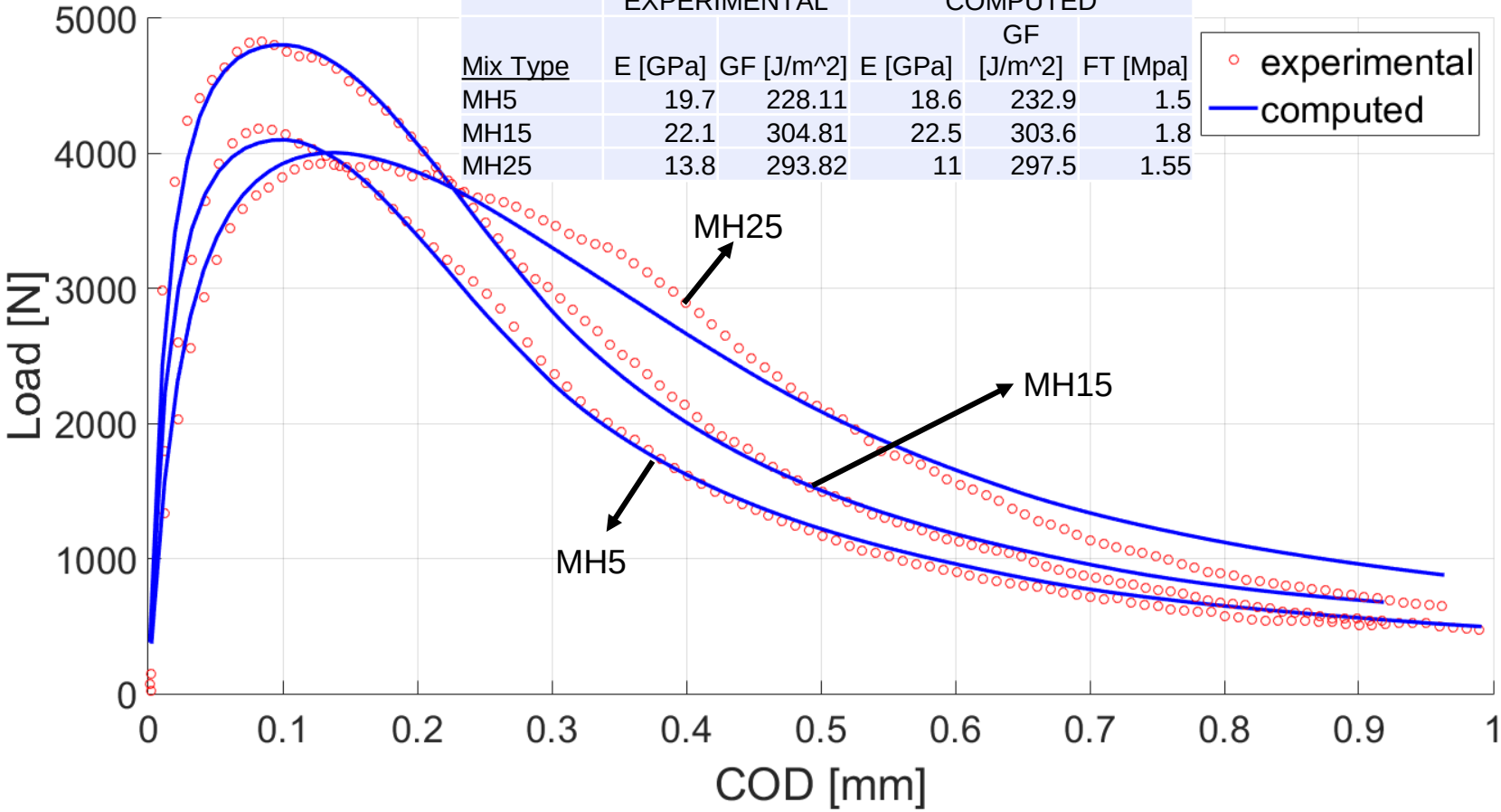
Optimization Algorithm

Nonlinear Least Squares (NLS)

Parameters

1) **Young Modulus**
2) **Tension strength**
3) **Fracture energy**

	EXPERIMENTAL		COMPUTED		
Mix Type	E [GPa]	GF [J/m^2]	E [GPa]	GF [J/m^2]	FT [Mpa]
MH5	19.7	228.11	18.6	232.9	1.5
MH15	22.1	304.81	22.5	303.6	1.8
MH25	13.8	293.82	11	297.5	1.55



Thank you for your attention!

Ilias Psilakis
ipsilakis@mas.bg.ac.rs

University of Belgrade
Faculty of Mechanical Engineering

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 955944 - RE-FRACTURE2.

RE-FRACTURE2 ITN EID PROJECT

MARIE CURIE ACTIONS