



CEACM  
**S 4 M L**  
CONFERENCE 2024

**Prague, Czech Republic, June 19-21, 2024**

1<sup>st</sup> CEACM Int. Conference on Synergy between Multiphysics/ Multiscale Modeling and Machine Learning  
organized by: Adnan Ibrahimbegovic & Anna Kucerova, UTC-Alliance Sorbonne Univ, IUF & CTU Prague

**PRO**

**GRAM**

[conference venue: CTU/ Civil Eng. Bld., address: Thákurova 2077/7, 160 00 Prague 6 - Dejvice]

Rooms: C204 & C208 // Wi-Fi net: CEACM / passwd: faqua76n78 / validity: Mon. 17.6.2024 - Friday 21.6. 2024

# WEDNESDAY, JUNE 19, 2024

(DL=30 min distinguished lecture, L=20 min lecture, O\*=10 min opening)  
(name of the presenting author in )

**8:30 – 9:20 Registration**

**Room C204**

**S-1: Synergy between Engineering Modeling and Machine Learning  
9:20 – 11:00 Session W1 [Chair: A. Ibrahimbegovic, A. Kučerová]**

**Room C204**

O\*: Opening of the 1st CEACM Int. Conference S4ML

**DL: A. Ibrahimbegovic, R-A. Mejia-Nava, S. Ljukovac, G. Grozdanic, H. Rana, G. Canario-Gomes**  
COUPLED SYSTEMS MECHANICS: SYNERGY OF NATURAL AND ARTIFICIAL INTELLIGENCE FOR  
CONSTRUCTING PREDICTIVE REDUCED MODELS

**DL: C. Farhat, F. As'ad**

MECHANICS-INFORMED MACHINE LEARNING FOR DATA-DRIVEN NONLINEAR VISCOELASTICITY

**DL: H.G. Matthies.**

THE CONNECTION BETWEEN PARAMETRIC ROMS, CONDITIONAL EXPECTATION, AND MACHINE LEARNING

**11:00 – 11:30 Coffee-Break**

**Atrium**

**11:30 – 13:00 Session W2 [Chair: C. Farhat, J. Zeman]**

**Room C204**

**DL: B. Sudret**

SURROGATE MODELLING USING SPARSE POLYNOMIAL CHAOS  
EXPANSIONS: A MACHINE LEARNING FLAVOUR

**DL: D. Straub**

UNCERTAINTY QUANTIFICATION FOR OPTIMAL DECISION SUPPORT

**DL: H.N. Najm**

UNCERTAINTY QUANTIFICATION IN COMPUTATIONAL MODELS OF PHYSICAL SYSTEMS

**13:00 – 14:00 Lunch-Break**

**Atrium**

**14:00 – 15:30 Session W3 [Chair: B. Sudret, D. Straub]**

**Room C204**

**DL: G. Meschke, C. Xu, G. Vu, B.T. Cao**

PHYSICS-INFORMED MACHINE LEARNING: A HYBRID EXPLOITATION OF SIMULATION  
AND MEASUREMENT DATA IN STRUCTURAL ENGINEERING

**DL: J. Zeman**

WANG TILES-ENABLED EXPLORATION, ROBOT-ASSISTED MANUFACTURING,  
AND SELF-ASSEMBLY OF MODULAR (META)MATERIALS

**DL: M. Vořechovský**

MESOSCALE DISCRETE MODELING OF MONOTONIC, CYCLIC AND FATIGUE LOADING OF CONCRETE

**15:30 – 16:00 Coffee-Break**

**Atrium**

**S-3: Modeling and Artificial Intelligence Decision Support for Bioengineering and Bio-fluids**

**16:00 – 18:00 Session W4 [Chair : N. Filipovic, T. Djukić]**

**Room C204**

**L: B. Milicević, M. Milosević, M. Kojić, V. Milovanović, N. Filipović**

ELECTROPHYSIOLOGICAL MODEL PARAMETER ESTIMATION USING GENETIC  
ALGORITHMS AND DEEP DETERMINISTIC POLICY GRADIENTS

- L: I. Saveljić, S. Macuzić Saveljić, B. Arsić, T. Djukić and N. Filipović**  
PREDICTION OF DRIVER'S OSCILLATORY COMFORT USING AN ARTIFICIAL NEURAL NETWORK IN CONDITIONS OF HORIZONTAL VIBRATIONS
- L: O. Pavić, T. Geroski, L. Dašić, N. Filipović**  
AUTOMATIC 3D RECONSTRUCTION OF CORONARY ARTERIES FROM ANGIOGRAPHY IMAGES
- L: T. Djukić, S. Tomasević, M. Anić, I. Saveljić, N. Filipović**  
SIMULATION OF PLAQUE PROGRESSION WITHIN A PATIENT-SPECIFIC CAROTID BIFURCATION RECONSTRUCTED USING A COMBINED DEEP-LEARNING APPROACH
- L: V. Simić, B. Milicević, M. Milosević, N. Filipović**  
PARAMETER OPTIMIZATION OF LIVER DRUG DELIVERY MODEL USING GENETIC ALGORITHMS
- L: A. Bou Orm, B. Kaoui**  
FLUID-STRUCTURE INTERACTION OF TWO-LEAFLET VALVES DYNAMMICS UNDER FLOW

**18:00 – 19:00 WELCOME RECEPTION FOR S4ML 2024**  
(admission all)

**Atrium**

# THURSDAY, JUNE 20, 2024

(L=20 min lecture)

(name of the presenting author in bold letters)

## S-2: Methods for Identification, Bayesian Inversion for model calibration and digital twinning in engineering

8:30 – 10:30 Session T1 [Chair: H.G. Matthies, N. Friedman]

Room C204

L: **N. Friedman**, B. Popovics, B. Kurent, A. Urbanics, B. Brank

GENERALISED UPDATING OF DESIGN PROCEDURES USING MEASUREMENTS FROM MULTIPLE SIMILAR AS-BUILT STRUCTURES

L: **K. Das**, J. Sýkora, A. Kučerová

MORPHOLOGY ASSISTED COMPUTATIONAL MATERIAL DESIGN

L: **T. Franković**, N. Friedman, U. Bohinc and B. Brank

DETERMINISTIC AND STOCHASTIC MODEL UPDATING FOR TWO CASE STUDIES

L: **D. Šilhánek**, A. Kučerová, P. Havlásek

INVERSE ANALYSIS OF SHRINKAGE-INDUCED DEFORMATION AND CRACKING PERFORMED ON CONCRETE BEAMS UNDER VARIED DRYING CONDITIONS

L: **J. Raisinger**, J. Eliáš

DEEP LEARNING APPLIED IN ESTIMATION OF MACROSCOPIC ELASTIC MATERIAL PROPERTIES

L: **M. Lebeda**, P. Kabele

EVALUATION OF APPARENT STIFFNESS OF ROCK MASS REPRESENTED BY A DISCRETE FRACTURE NETWORK MODEL

10:30 – 11:00 Coffee-Break

Atrium

## S-9: Inelastic Behavior of Materials and Machine Learning

11:00 – 13:00 Session T2 [Chair: G. Meschke, I. Kožar]

Room C204

L: **I. Kožar**

ONLINE MACHINE LEARNING FOR EQUATION BASED MODELING

L: **T. Veldin**, A. Stanić, B. Brank

EMBEDDED-DISCONTINUITY 3D-SOLID FINITE ELEMENT FOR MULTISCALE FRACTURE MODELLING

L: **A. Jurčević**, T. Lesicar, Z. Tonković, J. Sorić.

MULTISCALE PHASE-FIELD MODELLING OF FRACTURE RESPONSE

L: **A. Stanić**, N. Friedman, M. Nikolić, H.G. Matthies

ESTIMATION OF MATERIAL PARAMETERS WITH BAYESIAN INFERENCE IN DYNAMIC FRACTURE

L: **M. Nikolić**, M. Šodan, A. Urbanics, N. Friedman, A. Stanić

ESTIMATION OF FRACTURE PROPAGATION PARAMETERS BY USING EMBEDDED STRONG DISCONTINUITIES AND BAYESIAN FRAMEWORK WITH MACHINE LEARNING

L: **M. Šodan**, M. Nikolić, N. Friedman, A. Stanić

IDENTIFICATION OF MATERIAL PARAMETERS IN ENHANCED FRACTURE MODEL WITH THE EMBEDDED STRONG DISCONTINUITY

13:00 – 14:00 Lunch-Break

Atrium



**S-13: Data-informed uncertainty quantification towards decision-support**

**14:00 – 16:00 Session T3 [Chair: D. Straub, B. Brank]**

**Room C204**

**L: Kai Cheng, I. Papaioannou, D. Straub**

SEQUENTIAL DIRECTIONAL IMPORTANCE SAMPLING FOR STRUCTURAL RELIABILITY ANALYSIS

**L: O. Kanjilal, I. Papaioannou, D. Straub**

MULTILEVEL CROSS-ENTROPY METHOD FOR DATA-BASED STRUCTURAL MODEL UPDATING AND RELIABILITY ASSESSMENT

**L: M. Zlatic, M. Canadija**

RECONSTRUCTING THE MULLINS EFFECT WITH PHYSICALLY AUGMENTED NEURAL NETWORKS

**L: M. Smolnicki, S. Duda, G. Lesiuk**

CLUSTERING OF ACOUSTIC EMISSION EVENTS AS AN ANALYSIS METHOD OF COMPOSITE FRACTURE IN MULTI-AXIAL FATIGUE TESTS

**L: G. Lesiuk, M. Smolnicki, S. Duda**

PREDICTING STRESS INTENSITY FACTORS IN CTS SPECIMENS UTILIZING NUMERICAL SIMULATIONS AND NEURAL NETWORK

**L: R-A. Mejia-Nava, A. Ibrahimbegovic**

DEVELOPING A DAMPING MODEL FOR VIBRATION AMPLITUDE REDUCTION

**16:00 – 16:30 Coffee-Break**

**Atrium**

**S-8: Probabilistic Modeling and Computations**

**16:30 – 18:30 Session T4 [Chair: B. Sudret, J. Logo].**

**Room C204**

**L: S. Bérešová**

ADAPTIVE SURROGATE MODELS FOR THE ACCELERATION OF SAMPLING IN BAYESIAN INVERSION

**L: P. Konečný, P. Lehner, M. Horňáková**

EFFECT OF CONCRETE MATURATION ON THE VALUE OF THE DIFFUSION COEFFICIENT OBTAINED FROM THE EXTRACTED CHLORIDE PROFILE

**L: D.B. Merczel, M. Tantawi, J. Logo**

AN APPROACH TO OPTIMAL TIMBER-CONCRETE-STEEL HYBRID SLAB DESIGN

**L: M. Movahedi Rad, M. Habashneh, J. Logo**

PROBABILISTIC OPTIMIZATION FOR IMPERFECT STRUCTURES CONSIDERING UNCERTAIN LOAD APPLICATION POSITIONS

**L: M. Habashneh, M. Movahedi Rad, J. Logo**

INCORPORATING RELIABILITY-BASED DESIGN INTO DETERMINISTIC ELASTO-PLASTIC TOPOLOGY OPTIMIZATION AT ELEVATED TEMPERATURES

**L: L. Simwanda, M. Sýkora**

PREDICTION OF MOMENT CAPACITY OF ULTRA-HIGH-PERFORMANCE CONCRETE BEAMS USING EXPLAINABLE EXTREME GRADIENT BOOSTING MACHINE LEARNING MODEL

**19:30 – 22:30 CONFERENCE BANQUET AT Mlýnec Restaurant Prague.**

[web: <https://www.mlynec.cz/en/>]

(admission only with banquet tickets)

# FRIDAY, JUNE 21, 2024

(L=20 min lecture, O=7 min short lecture)  
(name of the presenting author in bold letters)

## **S-12: Structure Failure - Instability and Machine Learning** **8:30 – 10:30 Session F1A [Chair: I. Imamović, E. Hajdo]**

Room C204

- L: **E. Karavelić**, I. Imamović, A. Ibrahimbegovic  
MATURITY-STRENGTH MODEL FOR PREDICTION OF CONCRETE COMPRESSIVE STRENGTH
- L: **I. Imamović**, A. Ibrahimbegovic, E. Mesić, E. Karavelić  
BEAM MODELS CAPABLE OF REPRESENTING FAILURE OF STEEL FRAME STRUCTURES ACCOUNTING FOR CONNECTION BEHAVIOR
- L: **E. Hajdo**, E. Hadzalić, A. Ibrahimbegovic  
BUCKLING ANALYSIS OF PILES IN WEAK SINGLE-LAYERED SOILS
- L: **E. Hadzalić**, E. Hajdo, A. Ibrahimbegovic  
SEISMIC ASSESSMENT OF MULTI-STORY STEEL FRAME STRUCTURE ON PILE FOUNDATION
- L: **S. Suljević**, A. Ibrahimbegovic, S. Dolarević  
HYBRID THERMOMECHANICAL FORMULATION WITH ENHANCED PERFORMANCE IN THERMO-ELASTICITY AND THERMO-PLASTICITY
- L: **S. Ljukovac**, A. Ibrahimbegovic, M. Cohodar-Husić  
OPTIMAL CONTROL OF MULTIBODY SYSTEM WITH GEOMETRICALLY EXACT REISSNER'S BEAMS

## **S-6: Multiscale Modeling of Materials and Machine Learning** **S-10: Fatigue Behavior of Materials and Machine Learning** **8:30 – 10:30 Session F1B [Chair: M. Vořechovský, M. Doškář]**

Room C208

- L: **J. Daněk**, J. Pospíšil  
NUMERICAL ASPECTS OF INTEGRATION IN PHYSICS-INFORMED NEURAL NETWORKS MODELLING
- L: **M. Kučera**, M. Vořechovský  
REFINED ANALYTICAL MODEL FOR STATISTICAL STRENGTH IN QUASIBRITTLE MEDIA
- L: **O. Faltus**, M. Horák, M. Doškář, O. Rokoš  
THIRD MEDIUM CONTACT FORMULATION FOR MODELING OF PNEUMATICALLY ACTUATED METAMATERIALS
- L: **B. Werner**, G. Rauchs, P. Havlásek, A. Kučerová, B. Patzák  
SEGMENTATION OF CONCRETE MESOSTRUCTURES FROM CT IMAGES USING THE DEEP LEARNING SOFTWARE TOOL SURVOS2
- L: **Cunyi Li**, J. Fang, M. Jirásek  
PHASE-FIELD FRACTURE MODELS AND THEIR APPLICATION TO ADDITIVELY MANUFACTURED METALLIC MATERIALS
- L: **N. Ademović**  
COMPARING THE TOTAL-STRAIN CRACK MODEL AND ENGINEERING MASONRY MODEL: HOW CAN MACHINE LEARNING BE INTEGRATED

**10:30 – 11:00 Coffee-Break**

**Atrium**

## **S-4: Reduced Order Models of Coupled Systems Machine Learning and Uncertainty Quantification** **S-5: Engineering Software and Machine Learning** **11:00 – 13:20 Session F2A [Chair: F. DeVuyst, H.N. Najm]**

Room C204

- L: **F. De Vuyst**, K. Naffer-Chevassier, Y. Goardou  
AN EFFICIENT CAR DRAG SHAPE-PARAMETRIZED SURROGATE MODEL BUILT FROM A LIMITED-DATA MACHINE LEARNING ALGORITHM

- L: A Tiba, T. Dairay, F. De Vuyst, I. Mortazavi, J.P.B. Ramirez**  
PARTITIONED DATA-DRIVEN REDUCED ORDER STRATEGIES FOR DYNAMIC FLUID -  
STRUCTURE INTERACTION PROBLEMS
- L: L. Wicher, F. De Vuyst, C. Dupont, A-V. Salsac**  
SAFE REDUCED-ORDER MODELS STRATEGIES FOR SUSPENSIONS OF DEFORMABLE  
CAPSULES FLOWING IN MICROCHANNELS
- L: S. Sulc, B. Patzák, V. Šmilauer**  
MUPIF: FRAMEWORK FOR DIGITAL TWINS AND INTEROPERABLE SIMULATION PLATFORM  
FOR ADVANCED MATERIAL DESIGN
- L: T. Medřický, A. Heinlein, M. Doškář**  
ALTERNATIVE REDUCED-DIMENSION STRATEGY FOR OBTAINING ADAPTIVE  
CONSTRAINTS IN FETI-DP
- L: M. Doškář, M. Tyburec, M. Somr, M. Kružík, J. Zeman**  
MODULAR STRUCTURES: DESIGNS BYPASSING SCALE SEPARATION ASSUMPTIONS  
OF MULTISCALE APPROACHES
- L: M. Tyburec**  
GLOBAL TOPOLOGY OPTIMIZATION OF BENDING-RESISTANT STRUCTURES  
WITH CONTINUOUS CROSS-SECTION PARAMETRIZATION

### **S-11a Honoring Prof. Zdenek Bittnar Contributions**

**11:00 – 13:20 Session F2B [Chair: V. Šmilauer, B. Patzák]**

**Room C208**

- L: B. Pichler, A. Razgordanisharahi, M. Sorgner, T. Pilgerstorfer, B. Moritz, C. Hellmich**  
REALISTIC LONG-TERM PREDICTION OF STRESS LEVELS IN A SEGMENTED TUNNEL  
LINING: CREEP MECHANICS-BASED EVALUATION OF VIBRATING WIRE STRAIN MEASUREMENTS
- L: V. Šmilauer, J. Veselý, Š. Pešková**  
HYGRO-THERMO-MECHANICAL MODEL APPLIED FOR CONCRETE SLAB
- L: B. Patzák, M. Horák, V. Šmilauer, P. Havlásek, M. Jirásek**  
OOFEM: RECENT DEVELOPMENTS AND FUTURE OF OPEN SOURCE MULTI-PHYSICS  
FINITE ELEMENT CODE
- L: M. Jirásek, M. Šmejkal**  
CALIBRATION OF PHASE-FIELD MODELS FOR COHESIVE FRACTURE
- L: A. Kučerová, D. Jarušková, J. Sýkora**  
WHAT IS THE ACTUAL UNCERTAINTY IN BAYESIAN INFERENCE OF MATERIAL  
PROPERTIES FROM MECHANICAL TESTS?
- L: R Chudoba, A. Baktheer, M. Aguilar, B. Pichler, M. Vořechovský**  
ELEMENTARY FATIGUE DRIVING MECHANISMS IN CONCRETE: EXAMPLES OF MESO-,  
MACRO AND LIFETIME-SCALE MODELING APPROACHES
- O: D. Rypl, B. Patzák**  
25 YEARS OF SYSTEM STUDENT AT THE DEPARTMENT OF MECHANICS:  
GENESIS, EXPERIENCES AND PERSPECTIVES
- O: J. Němeček, J. Němečková, J. Němeček**  
MICRO-SCALE CREEP OF CEMENT PASTE QUANTIFIED BY NANOINDENTATION
- O: R. Vondráček**  
HISTRUCT - YET ANOTHER CLOUD BASED PARAMETRIC MODELLING SYSTEM

**13:20 – 14:20 Lunch-Break**

**Atrium**





# CEACM S4ML CONFERENCE 2024

Conference Website:  
<https://ceacm.net/s4ml-2024>

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