Expert-Guided MD3 Systems

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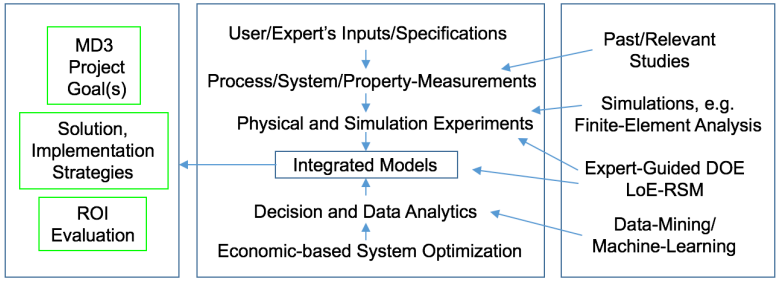
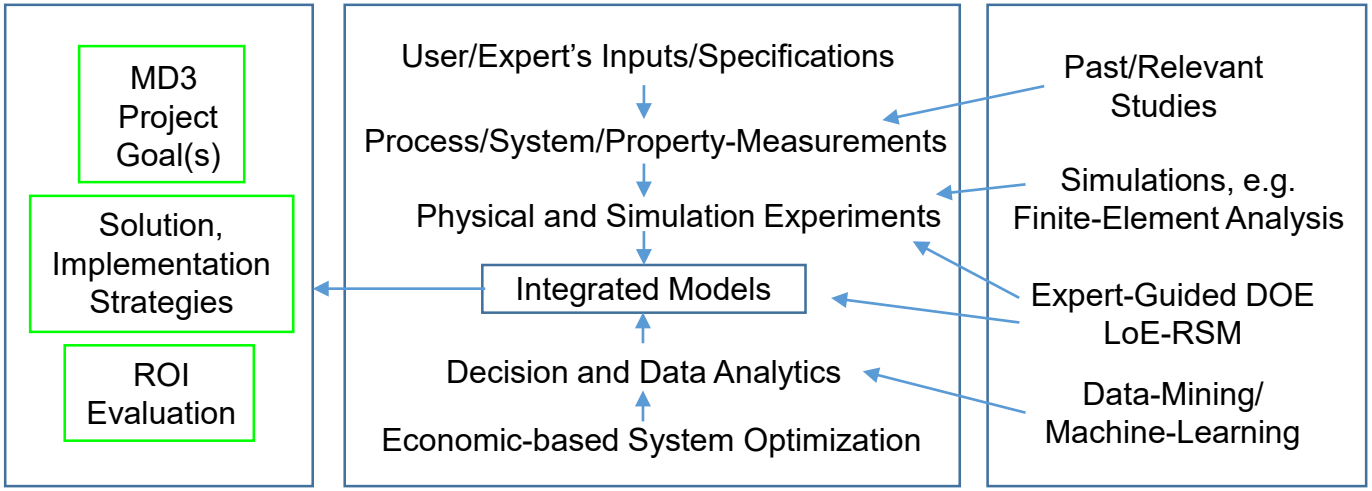
Objectives: Design and build a human-machine-interactive system to include industry and academic expert knowledge/guidelines in materials discovery, development and deployment (MD3). Building on user's current process/equipment foundation, the system follows user's inquiries to explore relevant work around project goals, providing a roadmap to reach the goals. The user will be able to adjust the roadmap for directing the system to provide detailed execution steps for a focused study.

Technical Approach: This effort will leverage our industrial project experience in solving company problems. It builds on our expertise in integrating process knowledge (including user inputs or specifications), past experimental outcome and system models to create a process/system model for understanding the strength and weakness of current practice. Then, our experience in MD3 and data analytics (e.g., expert guided design-of-experiment, layer-of-experiment oriented response-surface-method) would suggest the best solution strategy. Practitioner(s) would be able to interactively modify system specifications, process models or controllable variables for reviewing their impacts. Finally, executional details will be planned and return-of-investments shall be quantified.

Concept Illustration:



Impact: The system developed in this project will give practitioners a great tool to explore potential solutions for their problems systematically using MD3's analytical models. What-if explorations become possible. Learning is enabled through feedback from the integrated model. With cases and data gathered from various company clients the model-predictions will become more accurate, especially for newer systems, where experimental data might be scarce. They also serve as an excellent virtual experimental tool in teaching material and informatics courses, training student modeling and problem-solving skills.


MD3
Project
Goal(s)
Solution,
Implementation
Strategies
ROI
Evaluation
User/Expert's Inputs/Specifications
Process/System/Property-Measurements
Physical and Simulation Experiments
Integrated Models
Decision and Data Analytics
Economic-based System Optimization
Past/Relevant
Studies
Simulations, e.g.
Finite-Element Analysis
Expert-Guided DOE
LoE-RSM
Data-Mining/
Machine-Learning