

Summary of Days #1&2

ITER@CERN



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1. Relevant applications ...
 - a) Modelling of arcs in electrical circuits:
 - ✓ LHC 2008 accident – arc in an interconnect
 - ✓ ITER Coils – arcs during an unprotected quench
 - ✓ ITER Feeder arc
 - b) 3D heat propagation in accelerator magnets?
2. ... drive the development
 - a) ANSYS tool adapter for STEAM Co-Sim

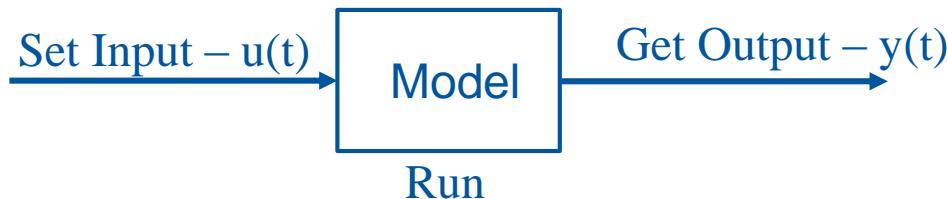


Implementing New Tool Adapters

1. Run existing model provided by the developer
 - A. Run monolithically with external input
 - i. validate execution from a command line
 - ii. validate I/O capabilities, parameter setting
 - B. Run with external input over several time windows
 - i. validate store/restore state
 - C. Run in a coupled scheme
 - i. validate information exchange with another model
2. Automatically build and run a model
 - A. validate a workflow
 - B. Redo 1.A-C



1.A Run existing model monolithically



| Tool | Input | Output |
|-------|----------|------------------|
| ANSYS | $I(t)^*$ | $R(t)^*, U(t)^*$ |

initialiseModel()
setInput()
setSimulationStudy()
executeStudy()



*evaluated over a subset of windings (available leads)

| ToolAdapter |
|---|
| - IOPort array - time window definition array - absolute tolerance array - relative tolerance array - maximum iteration array - convergence signal label + set simulation time + set initial conditions + exchange signals + set input + execute study + get output + check convergence |

Checklist

Can you programmatically:

- set external input
- initialise model
- set model parameters
- set solver parameters
- run model
- get output



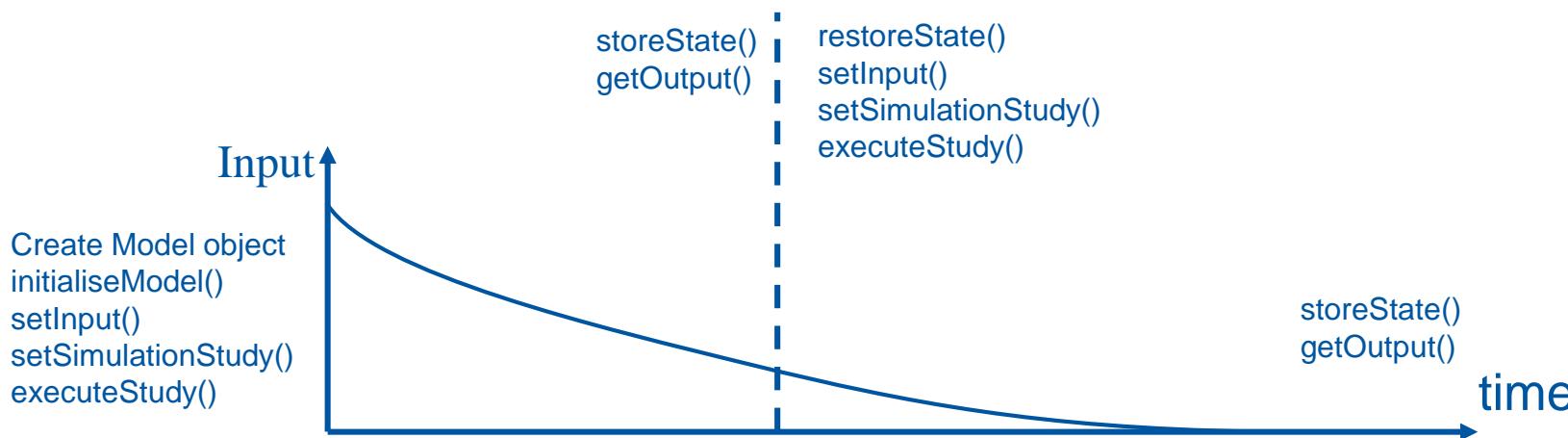
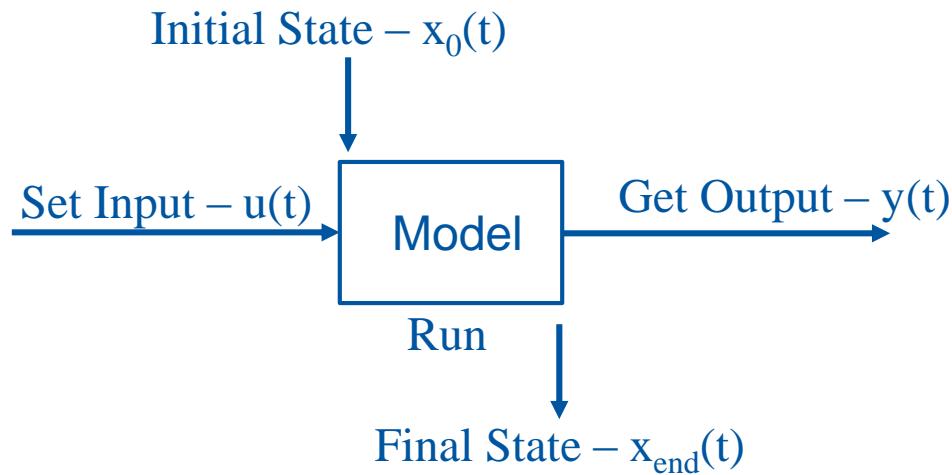
1.A Action Plan

For a simple thermal ANSYS model (1D heat propagation)

- set external input
 - ITER defines input file structure
 - CERN creates code to generate that file at a given location
- initialize model
- set model parameters
- set solver parameters
 - ITER defines what parameters are to be updated in the input file
 - CERN creates code to remove old file and create new file
- run model
 - ITER defines how to launch an APLD script from the command line
 - CERN implements that execution
- get output
 - ITER provides an output file format
 - CERN parses the file



1.B Run with external input over several time windows



Checklist

- Can you programmatically:
- store state
 - restore state

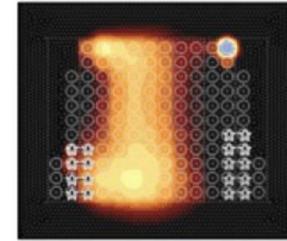
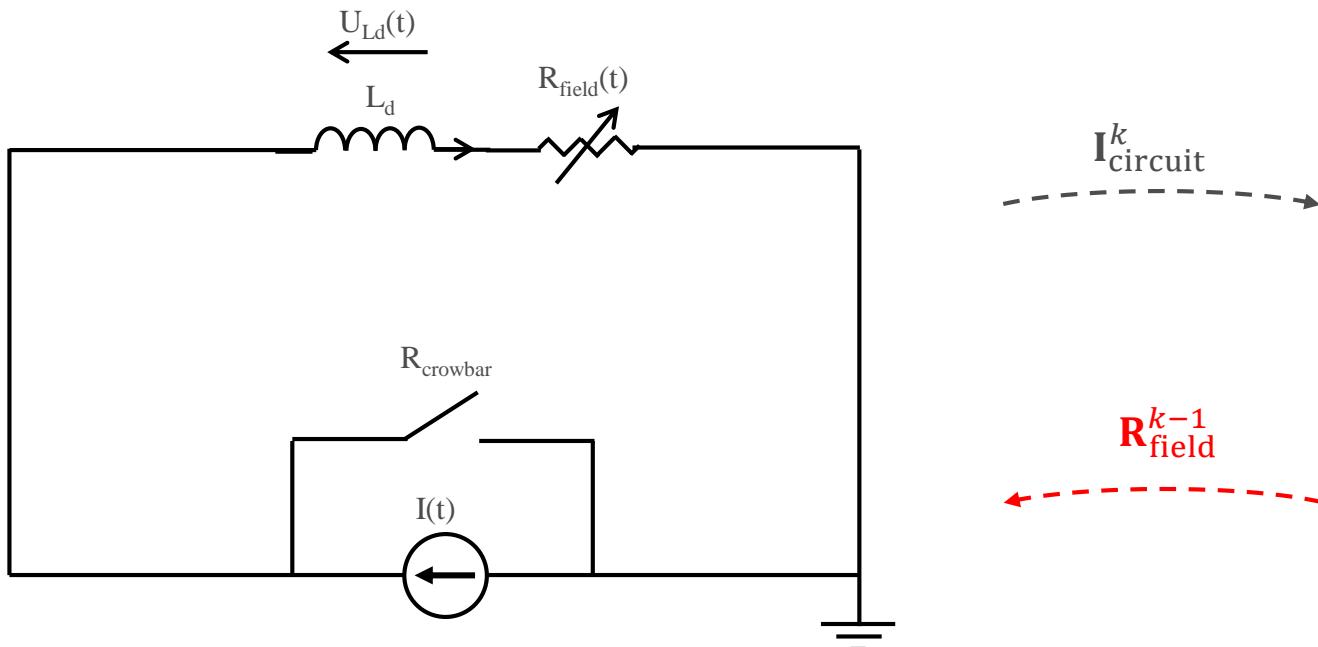
1.B Action Plan

For a simple thermal ANSYS model (1D heat propagation)

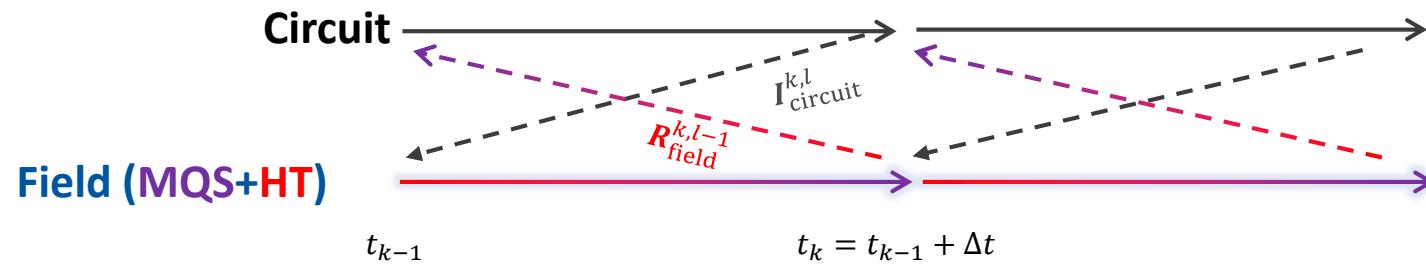
- store state
- restore state
 - ITER provides information how to handle storing/restoring state
 - CERN implements this functionality and releases a tool adapter



1.C Run in a Coupled Scheme



Waveform relaxation (Gauss-Seidel method):



1.C Action Plan

For a simple thermal ANSYS model (1D heat propagation) and a simple PSpice circuit

- ITER runs co-simulation with STEAM co-sim
- if needed, CERN supports the debugging process

