	Technical Guideline	Number	10.14e
B-MT	Documentation of Results from Mechanical and Thermo-Mechanical FEM-Simulations	Status	2011-04-04

Contents

1.   Scope

1) This document lists the requirements on reports of mechanical and thermo – mechanical FEM – simulations of technical objects.

2) This document does NOT define any parameters or procedures for performing FEM - Simulations.

3) This document does NOT describe the complete engineering documentation of any technical object.

4) This document is NOT related to any other purpose as aforementioned.

2.   FEM – Software

1) If possible, all mechanical and thermo – mechanical FEM - simulations shall be performed with the software ANSYS® Workbench, version 12.

3.   Documentation

3.1. Model Definition

1) Material data, relevant for FEM simulations must be documented in an adequate (digital and also printed) format and must be usable for the revision of the delivered results.

2) The coordinate system for geometrical models must be equal to as defined in correlated technical drawings.

3) The generated geometry data must be documented as STEP files.

4) The applied model must be documented with all relevant boundary conditions and necessary definition like for example

• Symmetry conditions,

• Boundary conditions and constraints which are for example

  - mechanical loads and forces (within a diagram),

  - forced displacements,

  - fixed temperature zones and applied heat loads,

  - thermal sources and sinks,

• Constraints which are for example,

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- contact definitions and friction factors,
- bearing conditions by degrees of freedom (within a diagram),
- heat transfer coefficients at surface contacts.

5) The reasons for the introduction of boundary conditions and constraints must be stated within the documentation.

6) Any simplifications for example of geometrical models or physical correlation must be justified within the documentation.

7) The applied model mesh must be documented with

- element type,
- number of Elements,
- mesh diagram, including zones of mesh refinement as magnified diagrams,
- warnings during meshing process (summarised).

8) All diagrams must be documented on separate pages within a full page format not less then DIN A4.

3.2. Solver Parameters

1) The accuracy parameters and the convergence diagram for the delivered results must be documented.

2) Solver warnings must be summarised and commented.

3.3. Results

1) All result plots as listed must be documented on separate pages within a full page format not less then DIN A4.

2) For static, isothermal mechanical calculations at least the following information must be provided:

- directional displacement (in mm) for each direction x, y and z separately as shaded colour-contour plot,
- combined displacement (in mm) as vector and shaded colour-contour plot,
- equivalent stress (in MPa) shaded colour-contour plots in combination with the combined displacement as scaled distorted geometry,

3) For static thermo-mechanical calculations at least the following information must be provided:

- temperature distribution as shaded colour-contour plot,
- heat flux (in W) through cross sections, relevant for the thermal loads,
- directional displacement (in mm) for each direction x, y and z separately as shaded colour-contour plot,
- combined displacement (in mm) as vector and shaded colour-contour plot,
- equivalent stress (in MPa) as shaded colour-contour plot in combination with the combined displacement as scaled distorted geometry.

4) Displacement plots and transient displacement displays (except vector plots or displays) must show a useful scaling for the deformation with in a distorted display. The scaling factor must be stated within the display.

5) At positions of special interest, for the mechanical stability of the simulated system, concrete numbers must be displayed.

6) Maximum values must be displayed with concrete numbers.

7) The colour code legend must be declared within each diagram.

8) For transient thermal, mechanical and thermo-mechanical calculations at least the following information must be provided as animated diagrams:

- transient temperature distribution in shaded colour-contour style,

- transient heat flux (in W) through cross sections, relevant for the thermal loads,

- transient directional displacement (in mm) for each direction x, y and z separately in shaded colour - contour style,

- transient combined displacement (in mm) in vector and shaded colour-contour style,

- transient equivalent stress (in MPa) in shaded colour-contour style in combination with the combined displacement in scaled distorted geometry.

9) Animation files must be delivered as animation data files together with the documentation.

4. Plausibility Check and Interpretation of Results

1) The plausibility of the FEM – results must be proven within suitable comparative calculations, documented within the report.

2) All significant results must be interpreted in detail within the documentation. Especially for stress maxima, displacement maxima, critical temperature distributions, critical heat fluxes or other critical results an interpretation must be stated.

5. Documentation Format and Data Transfer

1) All documentation must be delivered within compiled and structured files, including a table of content.

2) In case of text, tables, diagrams and pictures the electronic version must be delivered in the PDF-format without any access restrictions.

3) All FEM – Model files must be delivered together with the documentation

4) All documentation must be transferred into EDMS – documents following the relevant EDMS – guidelines.