



Contribution ID: 115

Type: Poster

ENGINEERING METHODOLOGY TO PROVIDE INTEGRITY OF THE ITER PORT PLUG ON-BOARD COMPONENTS DYNAMICALLY RESPONDING TO PLASMA TRANSIENTS COMBINED WITH SEISMIC EVENTS

Monday, 5 June 2017 13:40 (2 hours)

Forschungszentrum Jülich and partners have been developing the ITER upper port plug diagnostic system (cCXRS) that is to transmit the visible light from the plasma to the end diagnostic via optical mirrors.

Each port plug (PP) and its on-board components should withstand severe loads due to the plasma transients when the eddy currents and electromagnetic (EM) forces occur in the PP massive structures and its on-board components. The worst loading case can be found, and the forces be applied as a time-history loading to the PP mechanical model.

In addition, huge transient eddy current and shock dynamic EM forces occur in the vacuum vessel (VV). In response to this loading the VV vibrates, thus exciting the PP and, consequently, its on-board components. ITER Organization has studied a wide range of plasma transients to provide the enveloped Floor Response Spectra (FRS) for different VV locations.

The main computational problem is a reasonable superposition of a deterministically calculated time-history PP response to the applied EM forces with the PP response to the VV excitations that are specified as a FRS at the port stub (port attachment to VV) when only the maximum values of the structure response are calculated over a range of frequencies. On top of this, the EM loads should be combined with the seismic ones which are also specified as a FRS.

This paper considers a potential methodology for combining plasma transients with seismic events. It is not yet intended for design purposes. The paper presents a step-by-step numerical modeling of the upper PP hosting some representative cCXRS component. Approaches to calculate the EM forces in the PP and its on-board components with the use of the dedicated global EM ITER model and to perform a subsequent structural dynamic analysis using a dedicated PP model are presented. The response spectrum analysis (RSA) of the PP and its on-board component that are excited via the VV due to the plasma transients and seismic events are then discussed. The challenge of combining closely spaced modes is highlighted. The approach to superimpose the time-history and RSA results is represented. A conservatism of the proposed approach, its requirements and merits are discussed. The technique proposed herewith is especially demanded when the dynamic behavior of the on-board component is a key feature of its design. This methodology gives a direct and transparent engineering way to design and estimate mechanical strength of the PP on-board components. The analysis uses reliable port stab FRS input and does not depend on spectra-to-spectra recalculation procedure (from port stab to component attachment) that is well established for the seismic-type response spectra but needs to be validated for the FRS due to plasma transients.

This work was supported by Fusion for Energy (F4E) under the Framework Partnership Agreement F4E-FPA-408 (DG). The views and opinions expressed herein do not necessarily reflect those of F4E.

Eligible for student paper award?

No

Authors: Dr ALEKSEEV, Alexander (ITER Organization); Mr PANIN, Anatoly (Forschungszentrum Juelich)

GmbH); Dr MERTENS, Philippe (Forschungszentrum Jülich GmbH); Dr SCHIOLER, Tyge (ITER Organization)

Presenter: Mr PANIN, Anatoly (Forschungszentrum Juelich GmbH)

Session Classification: M.POS: Poster Session M

Track Classification: Neutronics and multiphysics simulation