NUMERICAL SIMULATION APPLICATION

Application Description

In order to test IMAGE prototype, it was decided to select one of the ESA (European Space Agency) projects that were 'on going' in SENER at the same time that IMAGE. For this reason, SENER selected HERSCHEL S/C (Space Craft) OBA(Optical Bench Assembly) component.

ESA HERSCHEL main objectives are:

- Study formation of galaxies in the early universe
- Investigate creation of stars
- Examine molecular chemistry of the universe

One of the components of HERSCHEL S/C is OBA which, basically, must keep 'instruments' at a very low temperature, lower than 10 K.

OBA is going to work under very low cryogenic temperatures, that require the use of FEM (Finite Element Programs), DEM (Difference Element Methods) and CAE (Computer Aided Engineering) programs.

As standard in ESA projects OBA must be simulated at Component Level and System and or S/C level

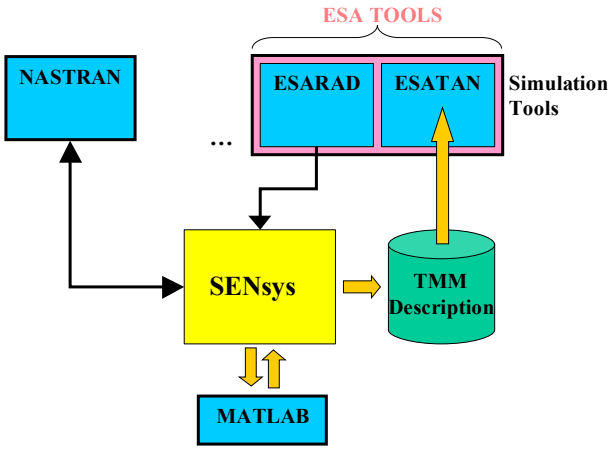
At component Level OBA will be analysed to Structural and Thermal aspects.

The paramount structural calculations will be:

- Static (Thermo – Elastic)
- Dynamics (frequency Domain)

The static calculations are basically thermo elastic calculations that must be performed using NASTRAN. With respect to the Thermal simulations mainly two simulations are carried out:

- Radiation Multi reflection View Factors + Environmental Impinging Energies.
- Temperatures and Heat Fluxes Evaluations.

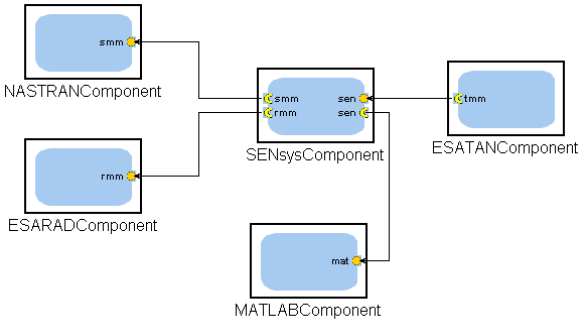


To perform radiation view factors and environmental impinging energies ESARAD program (from ESA) should be used and on the other hand, to evaluate temperatures and heat fluxes ESATAN program (from ESA) must be used.

Application Structure

In order to run the complete thermal analysis it has been needed to define the following components within the IMAGE framework:

- Structural Component (NASTRAN wrapper) providing on one side an interface to the IMAGE framework and on the other side an interface to NASTRAN.
- Radiation Component (ESARAD wrapper) providing on one side an interface to the IMAGE framework and on the other side an interface to ESARAD.
- Thermal Component. It is the one in charge to execute ESATAN. It provides on one side an interface to the IMAGE framework and on the other side and interface to ESATAN.
- SENsys Component. It is concerned with translating from a format to another to map information of two architectures. This component will be in charge to run specific routines to transfer data from NASTRAN analysis tool and ESARAD analysis tool to ESATAN analysis tool.
- MATLAB Component. It is connected with the SENsys Component to make the numerical calculations that are needed for obtaining the thermal mathematical model.

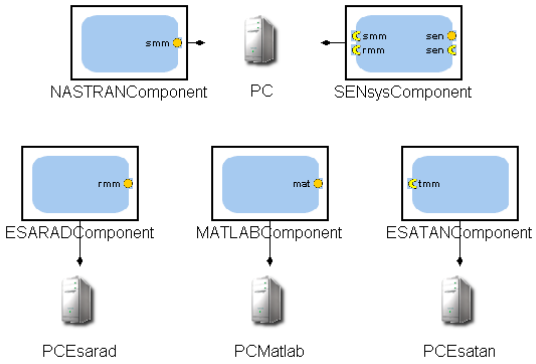


The figure shows the application structure defined using GME (Generic Modeling Environment) the tool selected by the IMAGE consortium to modelize the different applications.

Application Deployment

Deployment is the process of installing or updating Software components into the Component Server infrastructure.
With component specification becoming popular, IMAGE provides deployment module that handles automatic deployment of a CORBA® component independent of the platform.

In the current application, due the kind of license of the different tools involved in the analysis it was necessary to deploy the components as it is shown in the figure.



Application procedure

The procedure used to carry out the test case is as follows:

- Modelling
  - In GME, a new project, based on the IMAGE paradigm, is created.
  - We create five new components (NASTRAN, SENsys, ESARAD, MATLAB and ESATAN)
  - The interfaces and new complex types needed for exchanging data and connecting the application components are defined.
  - We create a new assembly that involves 1 instance of each component type.
  - Each component is deployed

- Launching

The system is launched.