

Real-time collaboration tools for CAD/CAE analysis review: a case study

Francesco Argese * Andrea Martini Rosario Dotoli Francesco Chionna Vito Palmieri

Consorzio CETMA, c/o Cittadella della Ricerca S.S. 7 - Km 706+030 - I-72100 Brindisi, Italy

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1 INTRODUCTION

Nowadays during review of complex systems, CAE engineers need to interact each others in order to evaluate results and for discussing on possible problems. Sometimes, experts involved in a detailed review are not in the same physical place, thus requiring travel expenses to complete the task. The use of new tools to improve remote collaboration should enhance the review activities and reduce expenses for a review meeting. Implementing remote collaboration related to CAE simulation is a challenging task due to both the needed scalability and the handling of users' interest. Further more, the distributed architectures require to solve real time synchronization and storage issues. Video conferencing is still the most used collaboration technology: it's already market-ready and allows to show understanding, forecast responses and give non verbal information but, if compared to face-to-face interaction, it shows many drawbacks, e.g. the capability to do synchronous and asynchronous operations [2]. This work describes a real-time and semi-immersive Collaborative and Virtual Environment (CVE) which allows remote collaboration over CAD and CAE simulations consenting both synchronous and asynchronous view to each remote participant.

2 METHODS

The system is based on results obtained experimenting a virtual prototyping platform to improve CAE analysis workflow [1] and this poster explains collaboration features added to those results. Our approach is based on a client-server architecture using an active replication approach [3], schematically depicted in Figure 1. Such method decouples the module which intercepts the events and the module which updates the scene thus allowing to send only the messages related to events (e.g. events from mouse or keyboard) without sending the changes to the scene which are

*corresponding author, francesco.argese@cetma.it

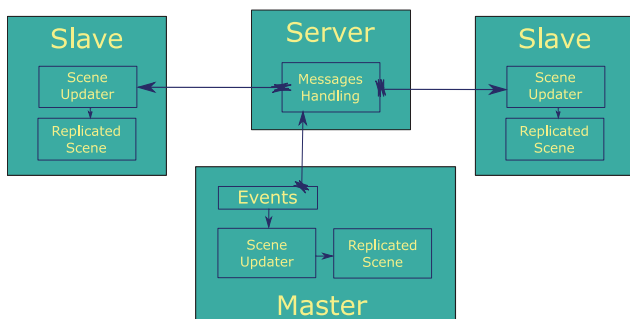


Figure 1: Client-server architecture

applied separately on each client. The participant having the control (a.k.a. the master) can interact with the scene while the others (a.k.a. the slaves) see the same modifications. Each event can generate a modification to the scene, that is replicated on all participating clients. Such approach has low requirements in terms of network bandwidth and allows to handle on each client the point of view of the scene independently, while having the same scene of the master as shown in Figure 2. Indeed, the master can change its view while other participants can choose having the same view of the master or having a customized view preserving the consistency with the scene of the master. This feature is based on filtering operations of messages and on the classification of messages: some messages are command messages, others are view messages; view messages can be filtered during the collaborative review session. At the start the first participant is also the master but each slave can require master permissions during the session.



Figure 2: Collaboration software during experimentation

The system allows to load CAD models (igs and stp formats) and CAE models (OpenFoam, LSDyna and vtk formats) supporting visualization of colour maps and animations. The system uses Delta 3D library for messages exchange and 3D visualization features, OpenCascade for loading CAD models and VTK to import CAE models. During the review session, the system supports the following features: stereoscopic visualization, loading of models, insertion of clipping planes, use of multimedia notes (e.g. text notes, images or video) pinned to a part of the scene, measuring distances, launching the animation of the CAE simulation and selecting a particular feature (e.g. velocity) for visualization.

3 RESULTS AND CONCLUSIONS

Extensive tests performed by designers and unexperienced users revealed that the use of such platform may enhance a design review session reducing the travels required to validate a particular design. However, further work is required to allow integration of native formats from CAD/CAE softwares.

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