

A Customized Job Manager for Metal Forming Simulations with LS-DYNA®

Yuzhong Xiao, Xinhai Zhu, Li Zhang, Houfu Fan
LSTC

Introduction

Generally the simulation time of the metal forming analysis is relatively short, but several numerical tryouts would be expected, due to the iterative modification of the forming tools based on the simulation results. Therefore it would be nice to provide a Graphic User Interface (GUI) for the user to manage the simulation jobs effectively (e.g. simplified submission procedures and quick file operations on the results), so that the total time cost could be further reduced. Also among various metal forming simulations, in addition to those with a single keyword file input, jobs that consist of several (e.g. the progressive die forming) or even dozens of sequential simulations (e.g. the iterative springback compensation process), are increasing. Based on these traits, a simple application (Job Manager) has been customized for our metal forming users with the intention to help them manage the simulation jobs.

Applications and settings of Job Manager

The submission of a multi-OP simulation

For multi-OP simulations like progressive die forming or springback compensation, the sequential submission of its OPs /stages is needed. And in most cases the precisions and the version of the solver would differ in different OPs. For example, the OP of implicit gravity or springback requires the double precision solver, while in the drawing and flanging simulations the single precision solver would be adequate but reduce the time cost. While new features are needed in trimming or springback compensation, official releases are still recommended for other common processes (e.g. drawing) because they are more stable.

Currently LS-PREPOST EZSetup has supported the setup of these jobs for metal forming users. The simulation of each OP will be performed in its own folder, making it clearer to process the results. A batch file will be created by LS-PREPOST EZSetup to perform the

simulations. Now a GUI (Job manager) has been further customized with enhanced features for the users to manage the simulation jobs more easily.

The submission of a multi-OP job in Job Manager is shown in Fig. 1. The batch file created by LS-PREPOST EZsetup can be directly loaded into Job Manager. Automatic detection of the job status can help the user easily start or resume the workflow, without checking which of the OPs are already completed. In these multi-OP jobs, file cleaning is another time-consuming task for forming users, since a large number of files would be created in different folders. In Job Manager, a job file clean filter is preset and can be customized by the user to help clean all files that are no longer needed with one simple click.

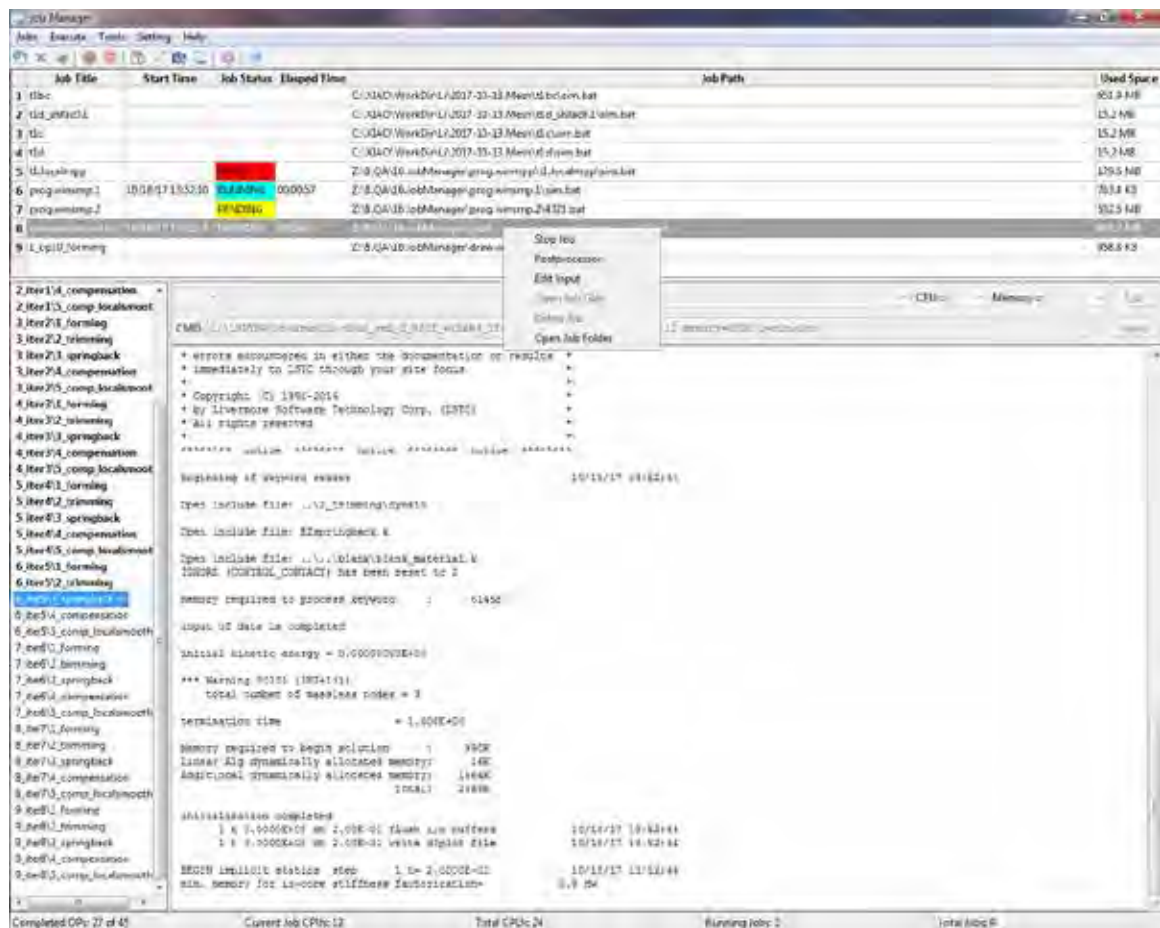


Fig.1 Multi-OP submission from the EZsetup batch file in Job Manager

The submission of a single process simulation

A common single submission (e.g. a single drawing simulation or the blank shape estimation with the one step method) is also supported by Job Manager. The solution

settings allow the user to select the preset default solvers, CPU and memory parameters, or directly browse for another solver and input the solution parameters manually, as shown in Fig.2.

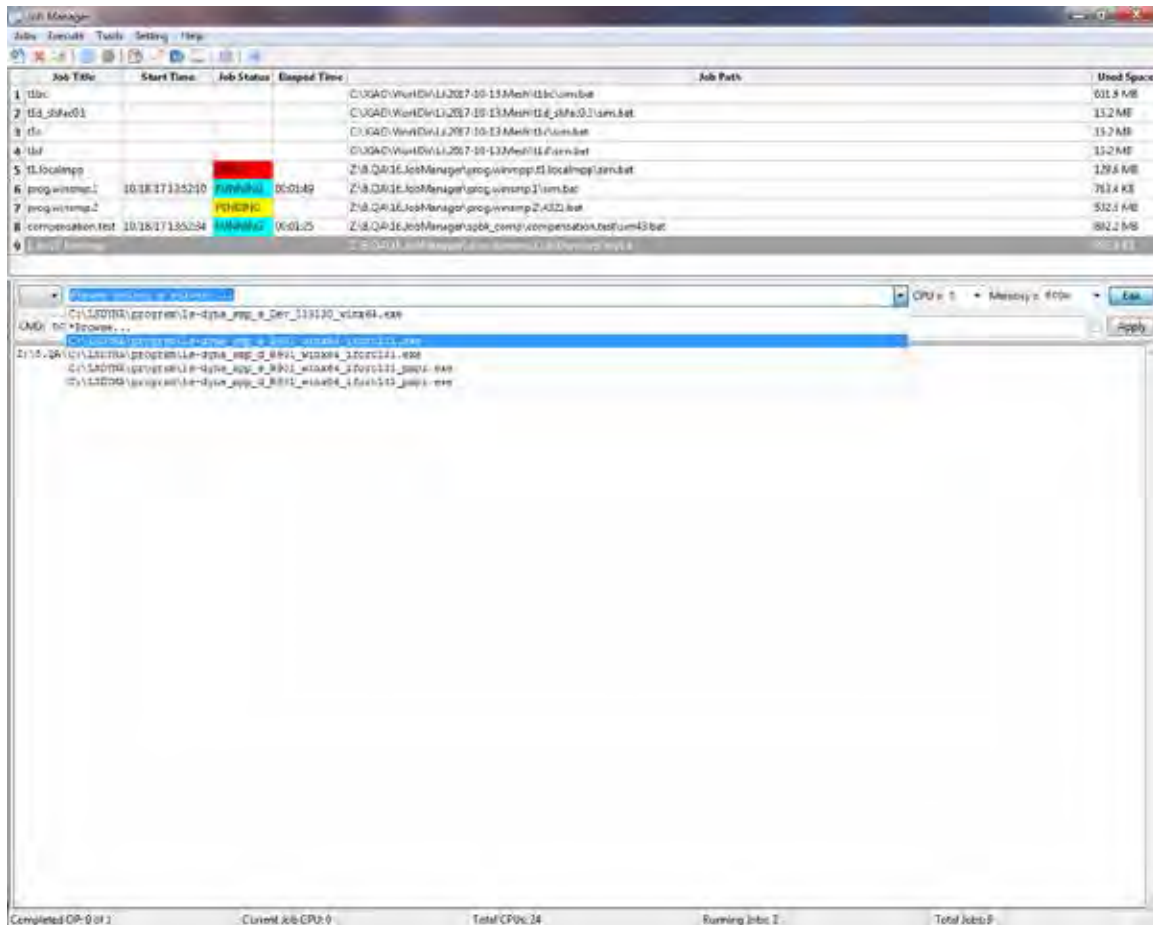


Fig. 2 Single submission of a single keyword inputdeck in Job Manager

The user settings in Job Manager

As shown in Fig.3, the user settings can be defined and saved in the configuration window.

The default parameter for the SMP and MPP solvers can be specified and become available in the solver lists as in Fig.2. Besides using local solvers, the submission commands can also be customized here according to the user's job submission protocol (currently working with Windows OS). So it is possible to run different OPs of the same job in the local workstation and HPC in a mixed manner (e.g. simulating forming in the HPC for the faster and stable solution with the official release, and then spring-back

compensation in the local workstation for the new features in a beta solver). The license setup let the user run LSDYNA with valid license info, without modifying the system environment variables (this is useful when the user has valid license info but no administrative privilege). It also allows the user to define the postprocessor, the text editor and the job file clean filter for quick file operations from the toolbar or the popup menus in the main window.

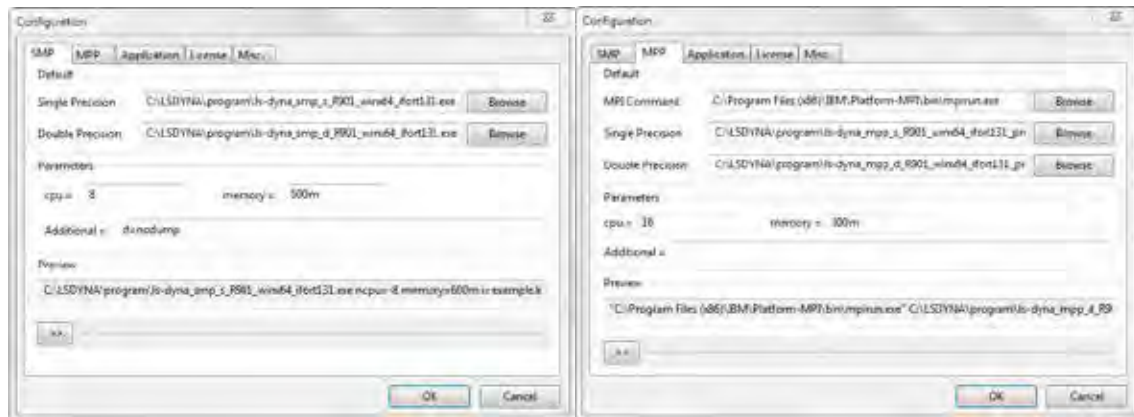


Fig. 3 the user settings in Job Manager

Current features of Job Manager

1. Supporting sequential submission of the multi-OP jobs in metal forming simulations (e.g. progressive die simulation) minimizes the possible waiting time between two OPs to reduce the total time cost.
2. Automatic multi-OP job status detection makes it easier for the user to resume the job correctly and prevent the possible file conflict in case of running tests in the same folder. Nevertheless the user can still start from a specified OP via the pop-up menu.
3. Two ways are implemented to add a job:
 - a) via GUI: the Windows batch file from EZSetup in LS-PREPOST or the LSDYNA keyword file can be loaded by using “Add job” button or directly dragging the file into Job Manager;
 - b) via command line: parameters can be passed to Job Manager so that the job can be added, started and deleted by a preprocessor (tested with an alpha version of LS-FORM).
4. The local SMP and MPP solvers are supported. It also works with the HPC that supports Windows submission command (tested with HPC of GM).
5. Real-time update of the solver message for the running job (local) allows the user to easily monitor the simulation progress.

6. The solver info can be loaded from the EZSetup file or manually defined, allowing the user to change the solver settings for a partially completed multi-OP job.
7. A fail-safe scheme is implement to instantly restore the work flow of running jobs upon staring Job Manager, in case of abnormal termination of Job Manger (crashed or terminated in OS for a update) .The current Windows batch has the limitation that the user would have to wait for the current OP to finish or kill it to restart the batch file in order to resume the process monitoring.
8. Utilities such as the popup menus, job grid sorting, simulation files cleaning and hard disk usage make it easier to manage the simulations (especially jobs consisting of dozens of OPs like springback compensation).
9. As a standalone executable, it allows the user to close the pre-processor after submitting the job. The user-defined shortcut to launch the post-processor also helps the user to quickly evaluate the results.

Summary

A user-friendly GUI has been customized for LSDYNA metal forming users, with the intention to help them manage the simulation jobs effectively and further reduce total time cost. The current version works in MS Windows. The future vision may also be extended to Linux.

Acknowledgement

Important help and valuable feedbacks from LSTC LSPP team are greatly appreciated. Special thanks go to General Motors Corporation for HPC tests.