Sample Pages From JarPro™ User's Manual

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INTRODUCTION

JarPro™, developed by Kalsi Engineering, Inc., is a general-purpose jarring program capable of performing many phases of jarring analyses ranging from detailed time histories of jarring impacts to jar placement optimization. This program uses a systematic stress wave tracking approach to closely simulate wave propagations in a drillstring. This approach enables JarPro to realistically model complex drillstring structures (e.g.: two-dimensional drillstrings, section changes, overshots, tapered drill collars, and accelerators) without difficulty. The detailed time history of force, velocity, and displacement at any section in the drillstring may be stored, printed, and plotted for an in-depth jarring analysis. On the other hand, the jar effectiveness may be studied in a single run over a specified range of variables for jarring optimization.

The major capabilities of JarPro can be summarized as:

1. Modeling two-dimensional drillstring configurations,
2. Jarring-up and jarring-down simulations,
3. Versatile drillstring modeling and ease of input (interactive, menu-driven environment),
4. Parametric analysis for jar placement, tripping force, stuck force, and stuck location,
5. Detailed time history of forces, velocities, and displacements at specified locations of the drillstring in a single run,
6. Jar placement optimization,
7. Jar placement and time history plots,
8. Side wall frictional effect modeling,
9. Buoyancy effect modeling,

10. Pump-open effect modeling,
11. Simulation of nonlinear force-displacement characteristics of jar accelerators,
12. Neutral point and weight indicator reading calculations.

An understanding of basic jarring principles and the simulation method used in JarPro are important to a successful modeling and analysis of a jarring problem. Section 2 provides a description of the basic jarring mechanism, the simulation methods, and modeling considerations in jarring analysis. Some of the items explained in Section 2 will become clearer after a review of the input details given in Section 3.

JarPro is designed to be a user-oriented computer program. As shown in Section 3, the input is quite simple. It basically consists of jarring parameter selection and drillstring modeling. The current version of JarPro allows users to create input files in an interactive, menu-driven environment. The analysis results are stored in output files as described in Section 3. Information regarding model limitations and error messages is given in Appendix A.

The program has undergone extensive verification, including over 20 direct comparisons against transient dynamic finite element runs and closed form solutions. Section 4 contains JarPro examples for the purpose of program verification and illustration. Some input and output files for the examples are included in Appendix B.

Figure 4.4(a)

Drillstring Model and Accelerator Spring Curve, Example 4

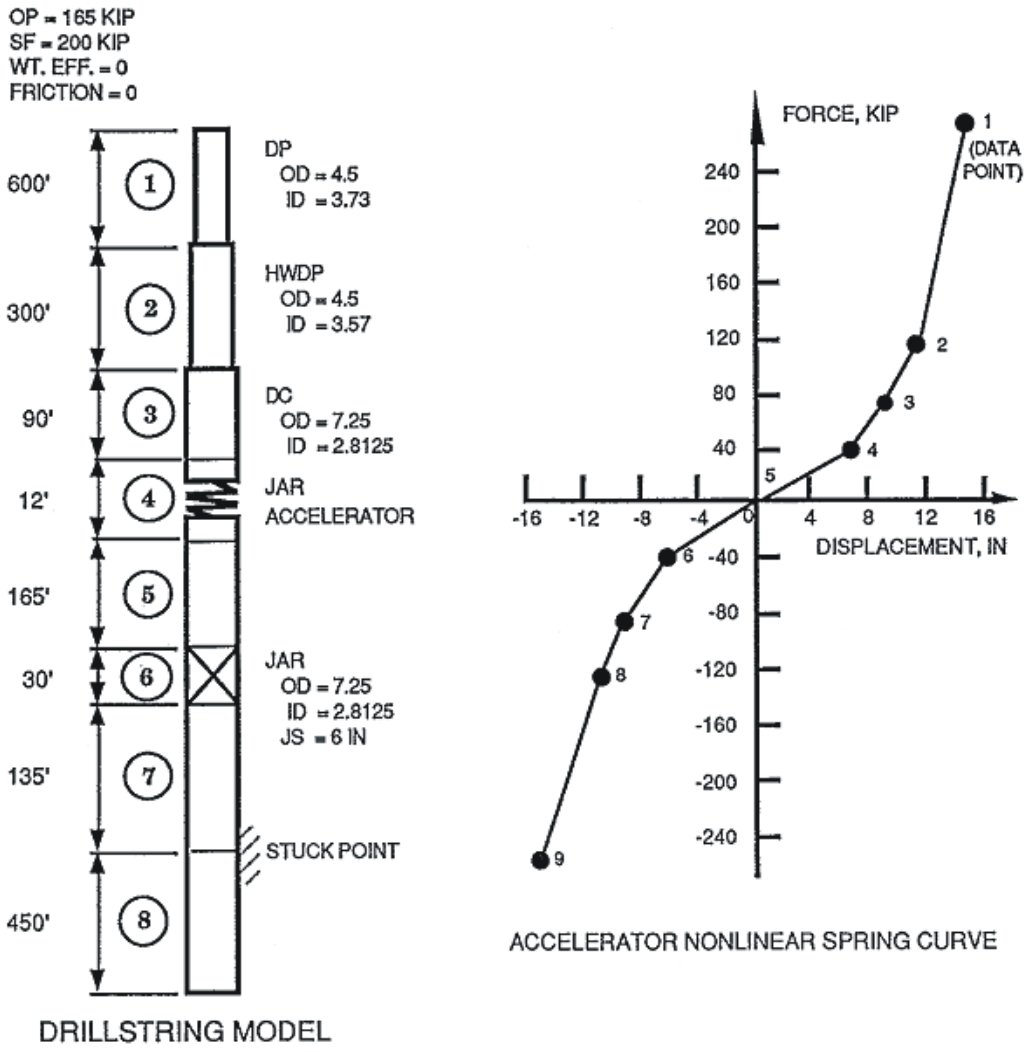

Figure 4.4(b)

Hammer Displacement Plot, Example 4

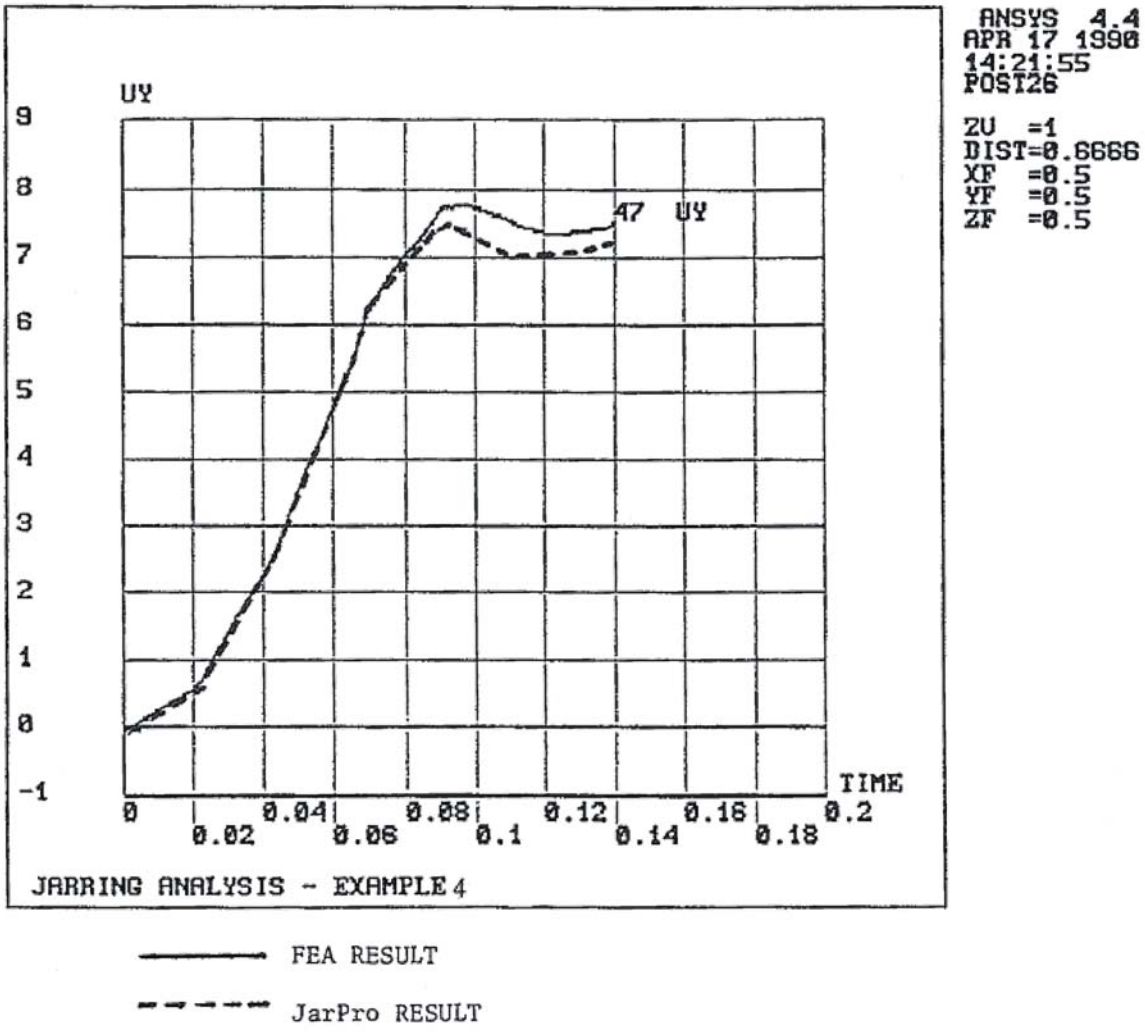

Figure 4.4(c)

Stuck Point Displacement Plot, Example 4

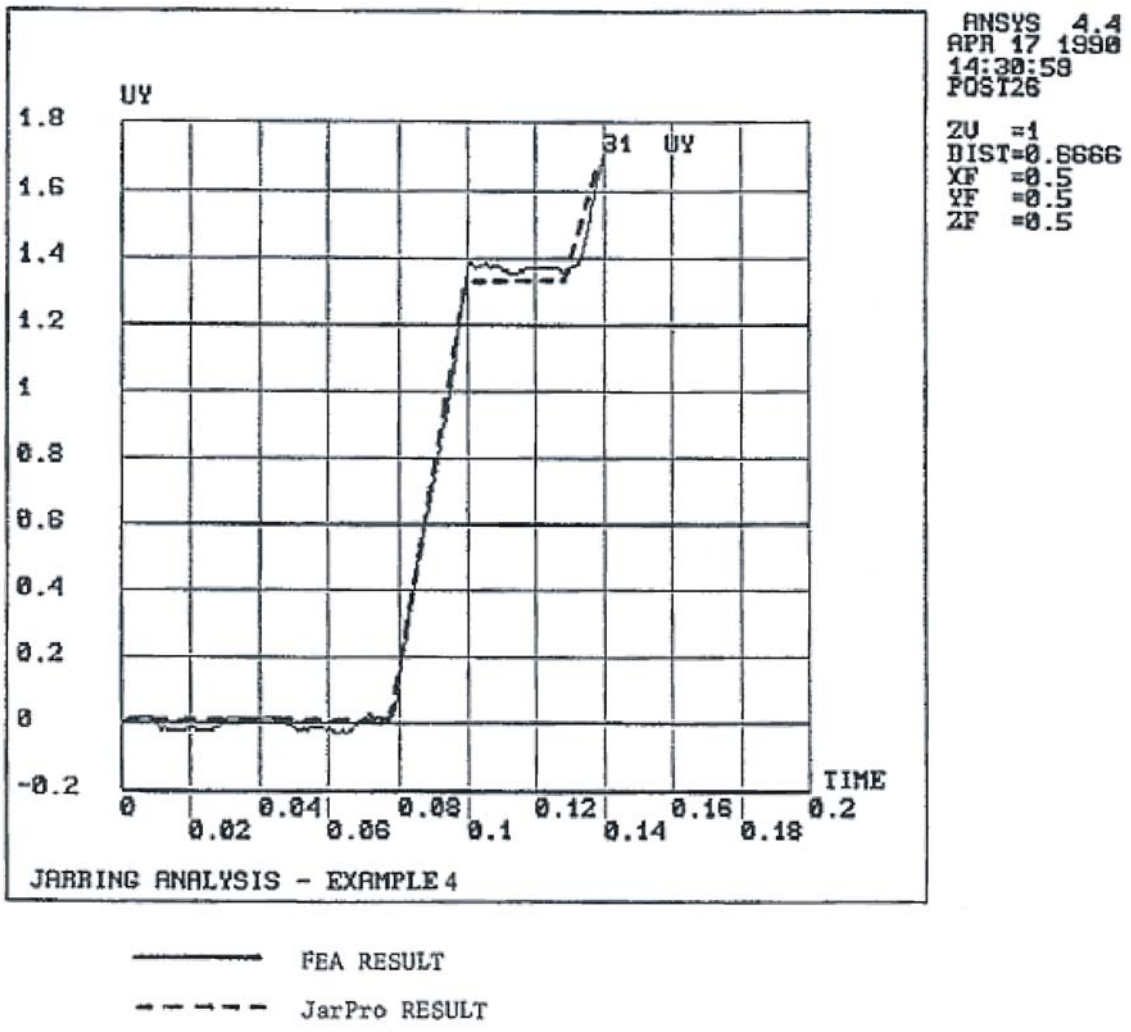

Figure 4.4(d)

Hammer Impact Force Plot, Example 4

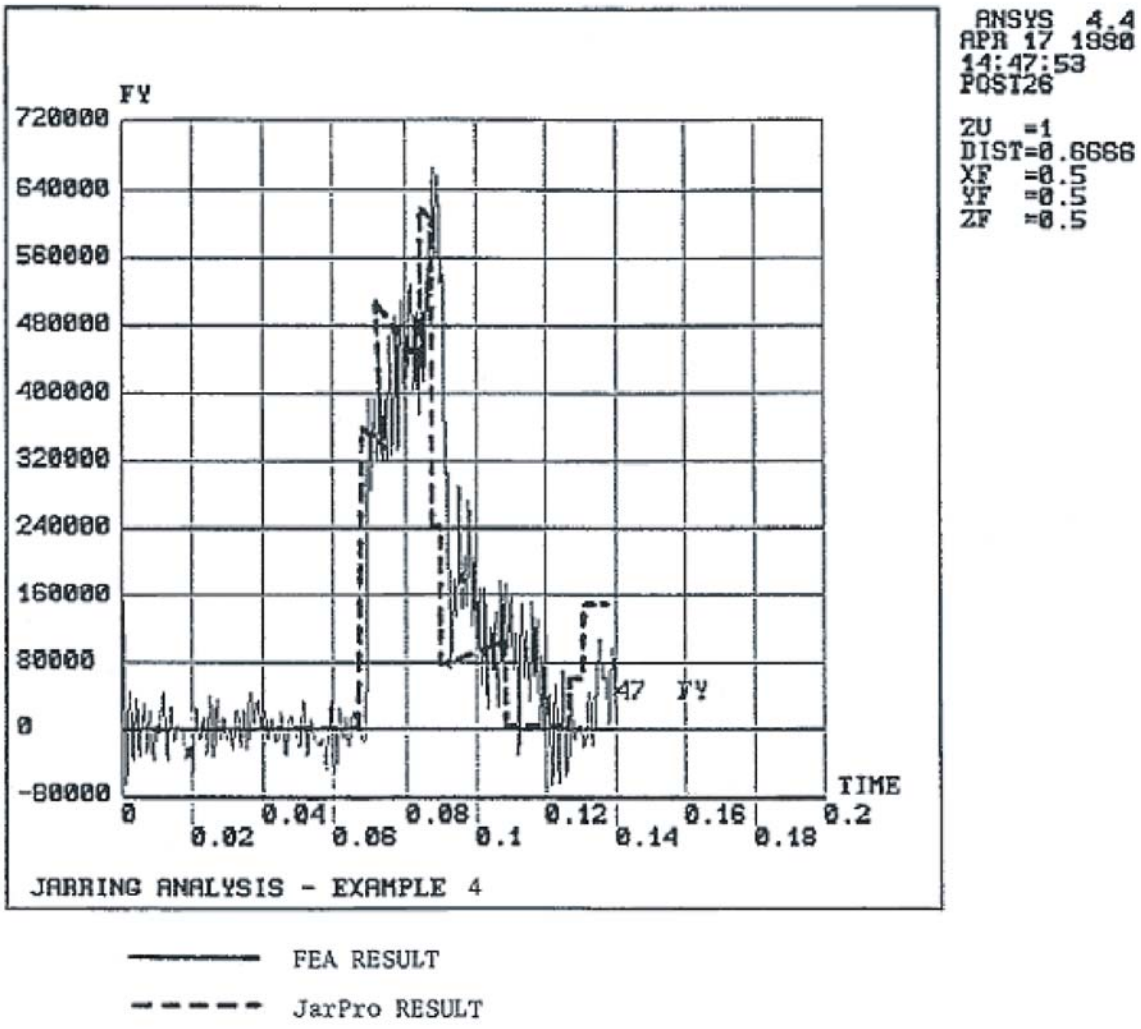

Figure 4.4(e)

Stuck Point Force Plot, Example 4

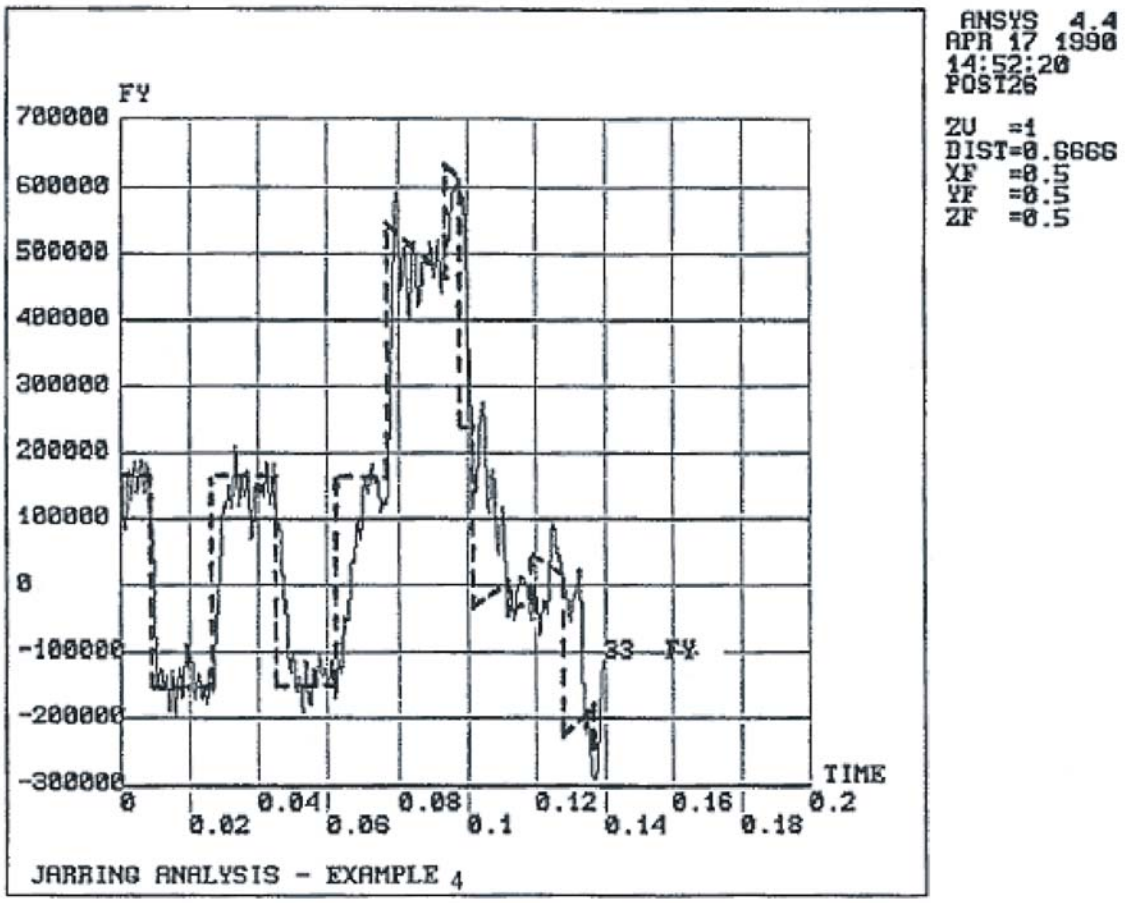

Figure 4.5

Jar Placement and Friction Effect Plot, Example 6

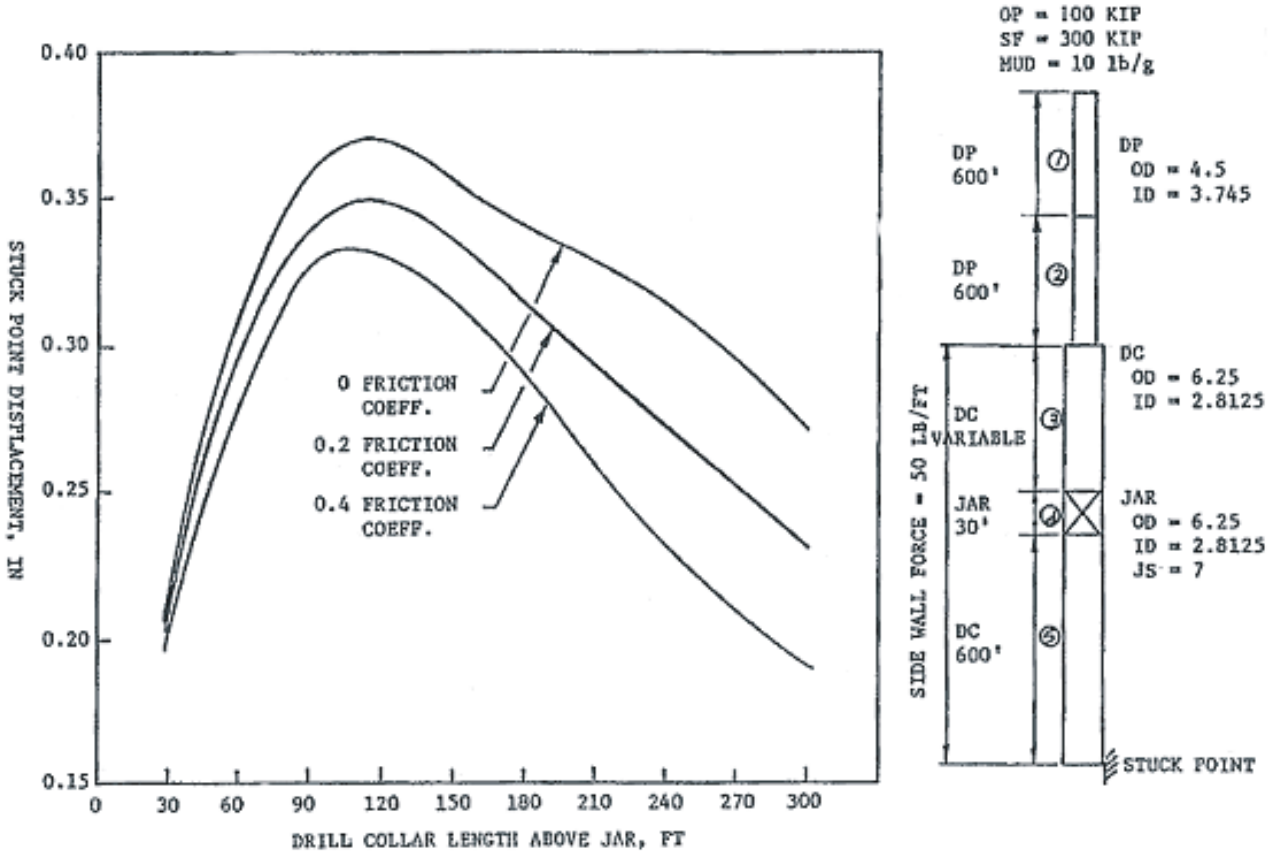

Figure 4.6(a)

A Two-Dimensional Drillstring Assembly, Example 8

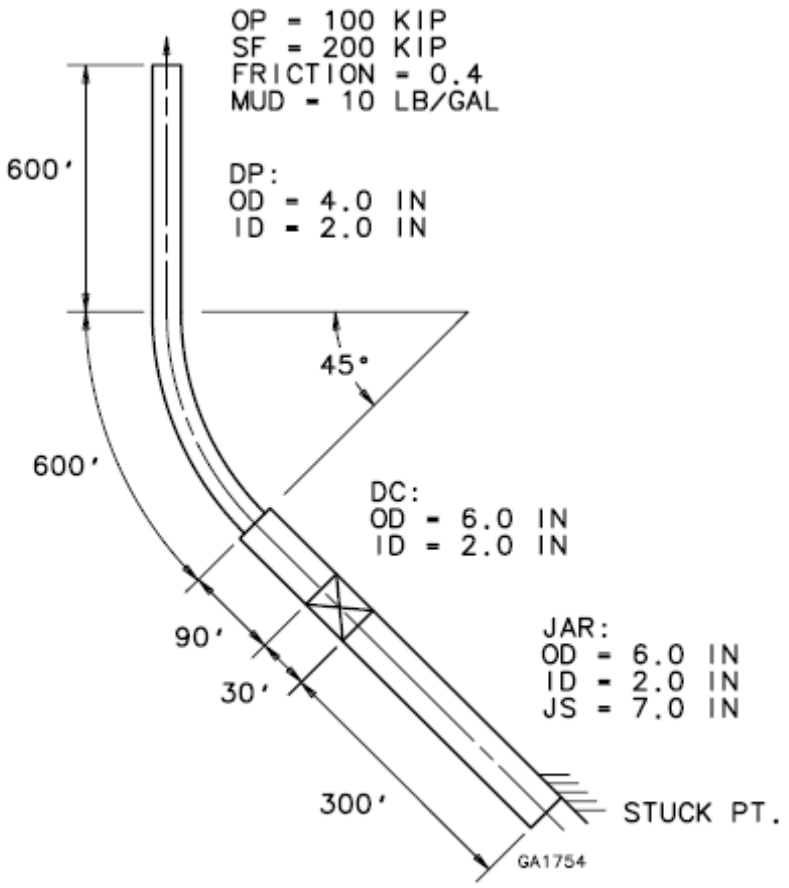

Figure 4.6(b)

Hammer Displacement Plot, Example 8

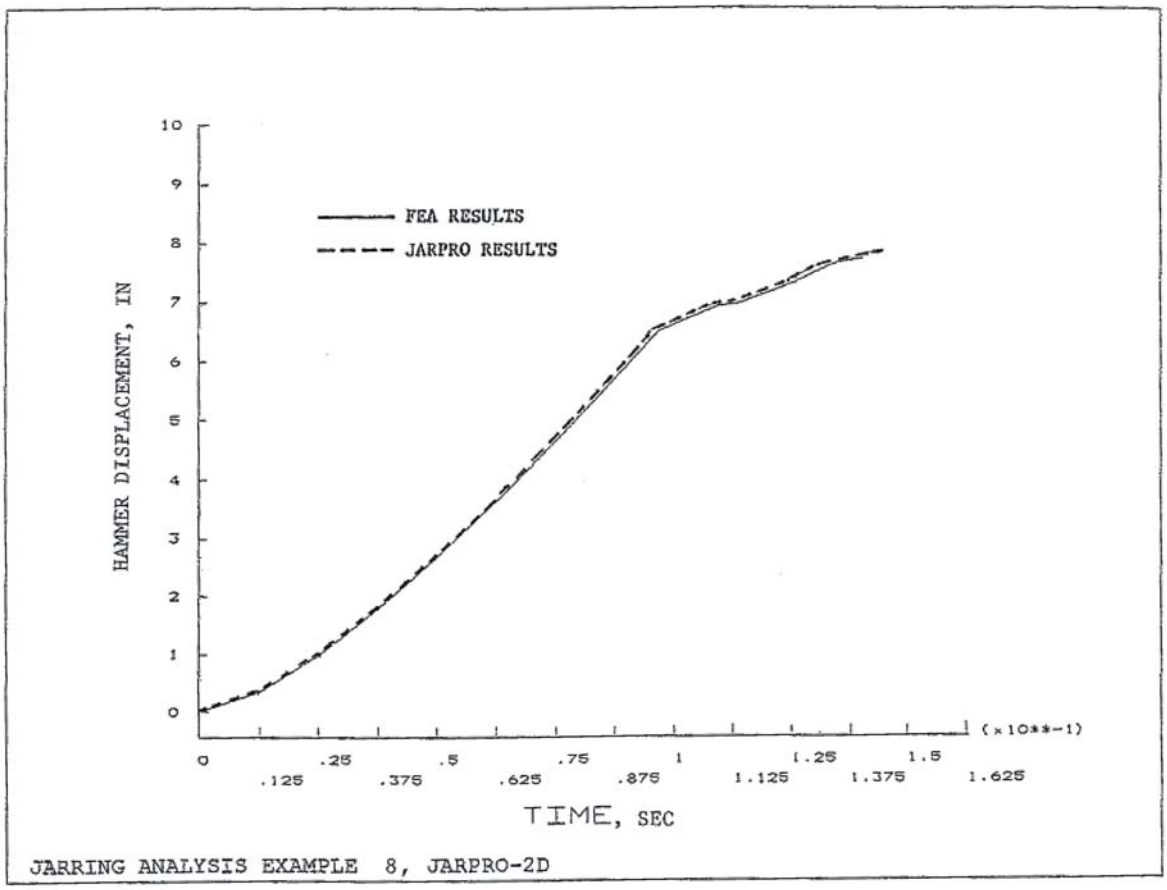

Figure 4.6(c)

Hammer Impact Force Plot, Example 8

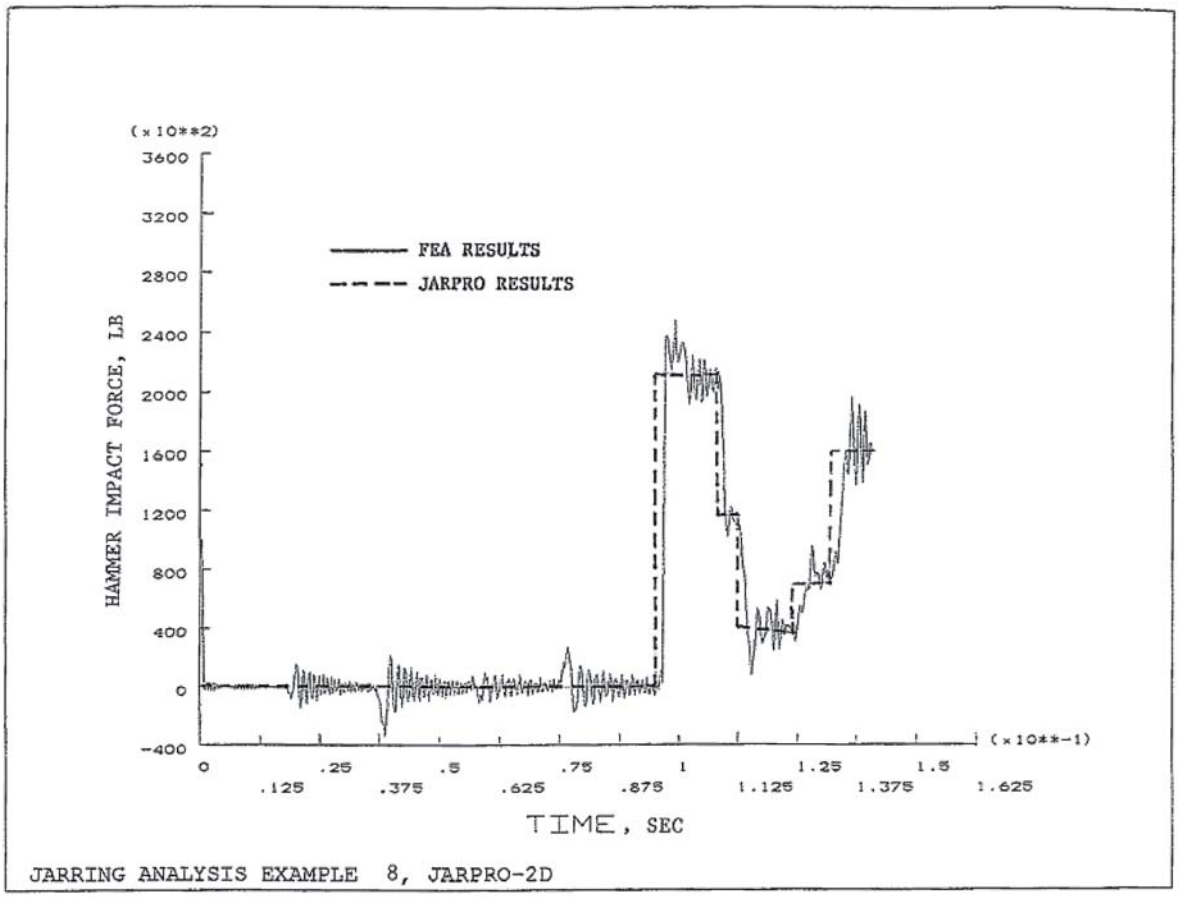

Figure 4.6(d)

Stuck Point Displacement Plot, Example 8

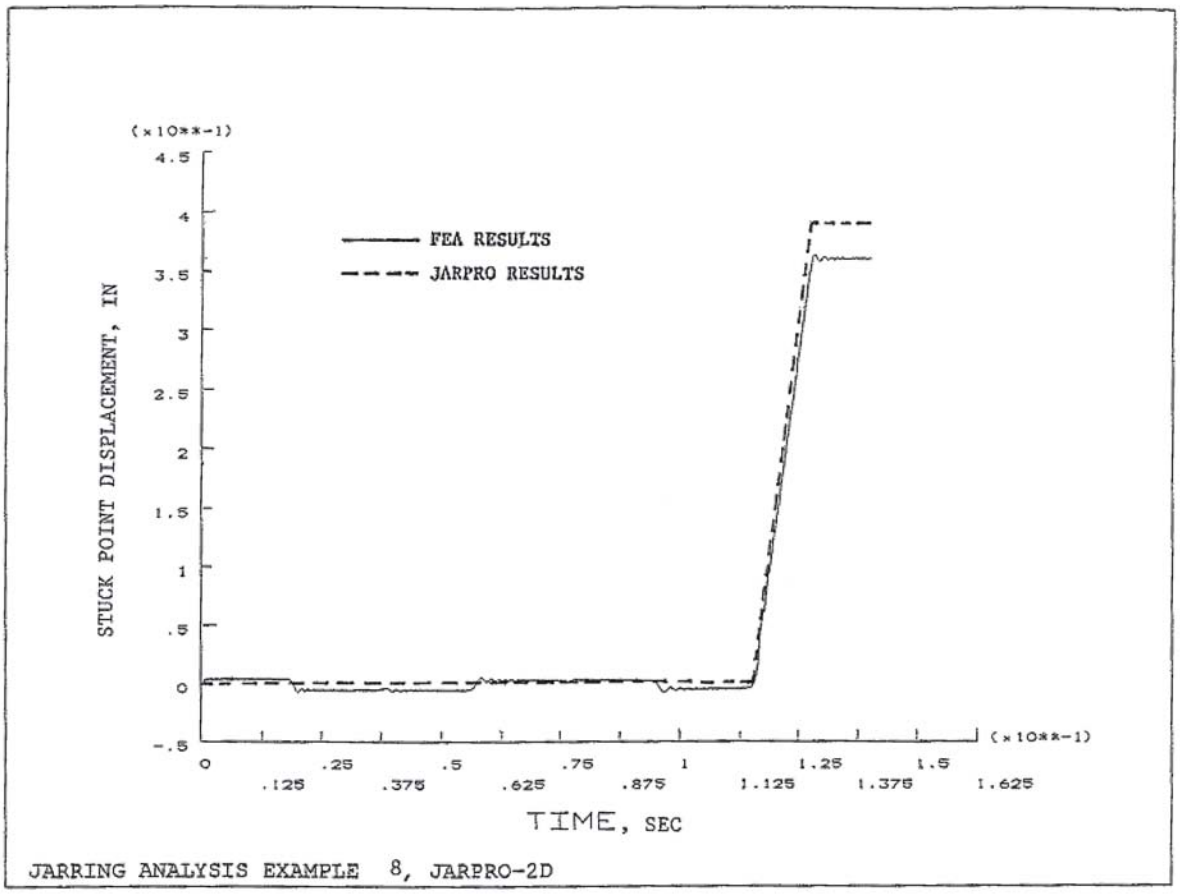

Figure 4.6(e)

Stuck Point Force Plot, Example 8