



Sample Pages From JarPro™ User's Manual

Document No. 2572, Rev. 1
April 2008

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KEI File No. 100.1.3

Table of Contents

Section		Page
1	Introduction	4
2	Jarring Simulation and Modeling Considerations	6
	2.1 Basic Jarring Process	6
	2.2 Drillstring Modeling	7
	2.3 Special Sections	9
	2.4 Friction and Buoyancy Effects	12
	2.5 Analysis Options	12
	2.6 Special Input	12
	2.7 Time Step and Simulation Time	13
	2.8 Time History Printout	14
	2.9 Execution Time Versus Accuracy	14
3.	JarPro Input and Output	17
	3.1 Input File	17
	3.1.1 Cover Sheet General Data	17
	3.1.2 Drillstring Data	18
	3.1.3 General Jarring Analysis Data	19
	3.1.4 Analysis Option Data	19
	3.1.5 Special Input Data	21
	3.2 Output File	22
	3.2.1 Cover Sheet	22
	3.2.2 Drillstring Table and Special Input Data	22
	3.2.3 Jar Specifications, Neutral Point, and Weight Indicator Readings	22
	3.2.4 Jarring Characteristic Analysis Output	22
	3.2.5 Jar Placement Analysis Output	23
	3.2.6 Jarring Variable Analysis Output	23
	3.2.7 Plotting of Analysis Results	23
	3.2.8 Error and Warning Messages	24
4.	Program Verification and Examples	30
	4.1 Example 1: Comparison of Wave Transmissions and Reflections	30
	4.2 Example 2: Comparison of JarPro and Stress Wave Equation Results for a Simple Jarring Case	30

4.3	Example 3: Comparison of JarPro and Finite Element Analysis Results for a Drilling Assembly	32
4.4	Example 4: Comparison of JarPro and Finite Element Analysis Results for a Fishing Assembly with a Jar Accelerator	32
4.5	Example 5: Jarring-Down Analysis	32
4.6	Example 6: Jar Placement and Friction Effect	33
4.7	Example 7: Effect of Short Sections	33
4.8	Example 8: Comparison of JarPro and Finite Element Analysis Results for a Two-Dimensional Drillstring Assembly	33
4.9	Example 9: Effects of Jar Placement and Side Wall Friction on a Two-Dimensional Drillstring Assembly	33
5	References	55

Appendix A: JarPro Limitations and Error Messages

Appendix B: Example Input and Output Files

1

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.

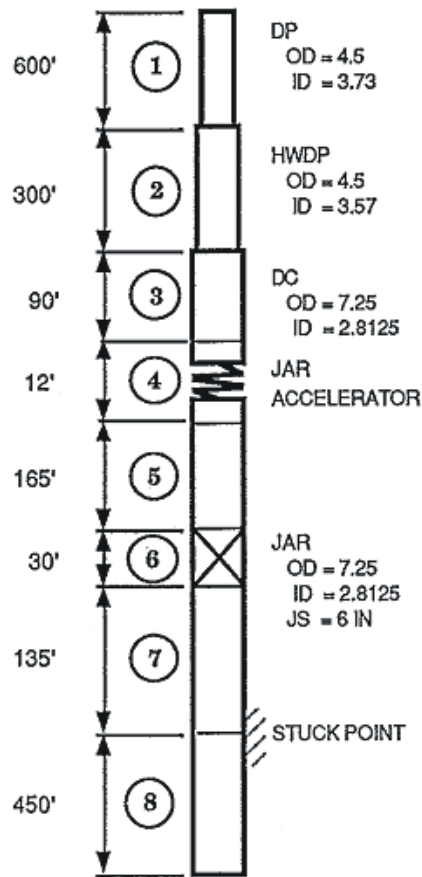
JarPro is designed to be a user-oriented computer program. As shown in Section 3, the input is quite simple. It basically consists of jarring parameter selection and drillstring modeling. The current version of JarPro allows users to create input files in an interactive, menu-driven environment. The 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.

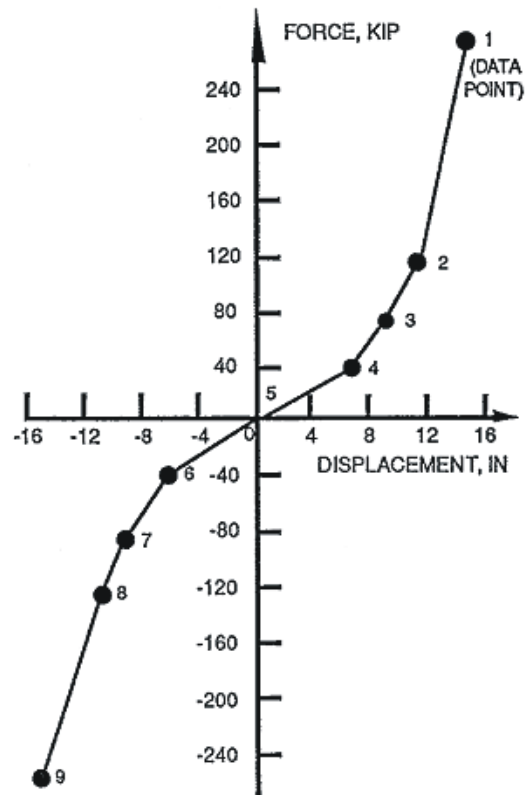
Figure 4.4(a)

Drillstring Model and Accelerator Spring Curve, Example 4

OP = 165 KIP
 SF = 200 KIP
 WT. EFF. = 0
 FRICTION = 0

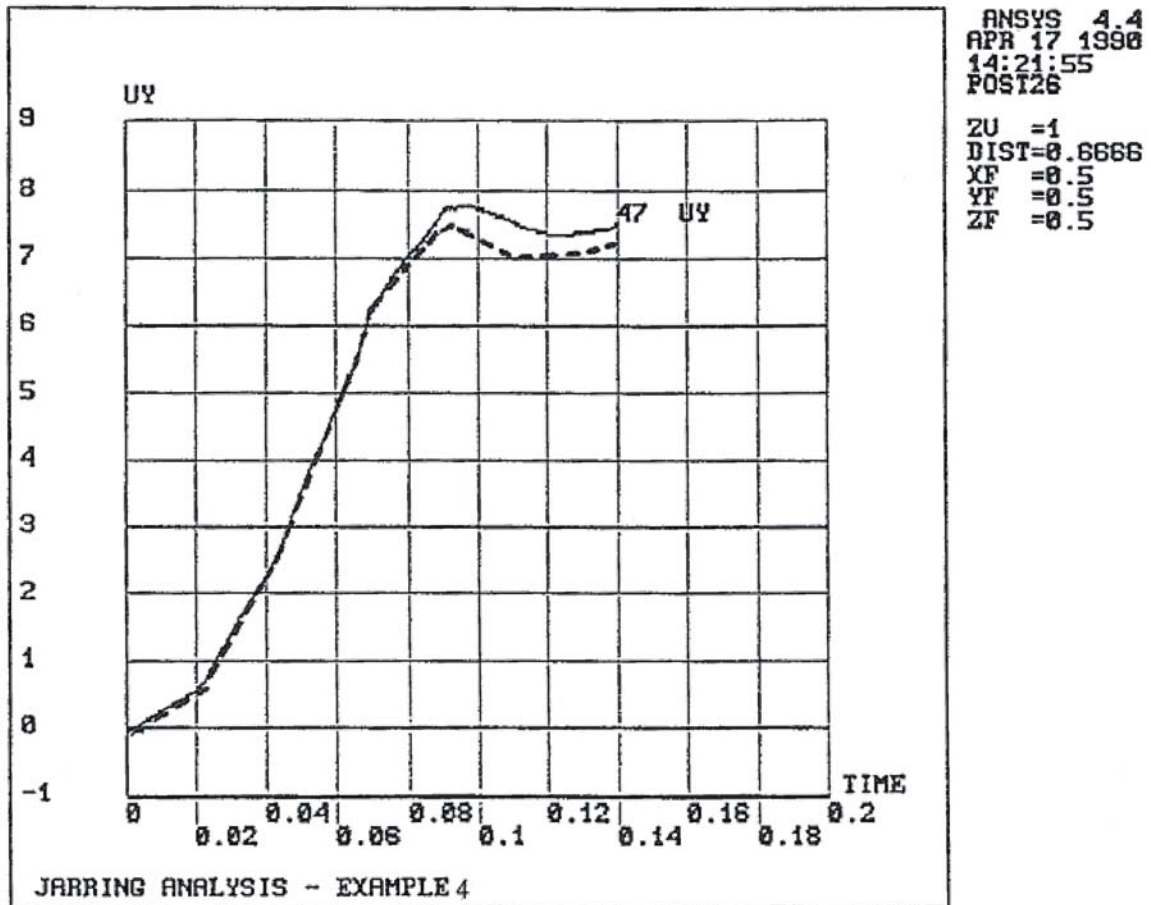


DRILLSTRING MODEL



ACCELERATOR NONLINEAR SPRING CURVE

Figure 4.4(b)
Hammer Displacement Plot, Example 4



———— FEA RESULT
----- JarPro RESULT

Figure 4.4(c)
Stuck Point Displacement Plot, Example 4

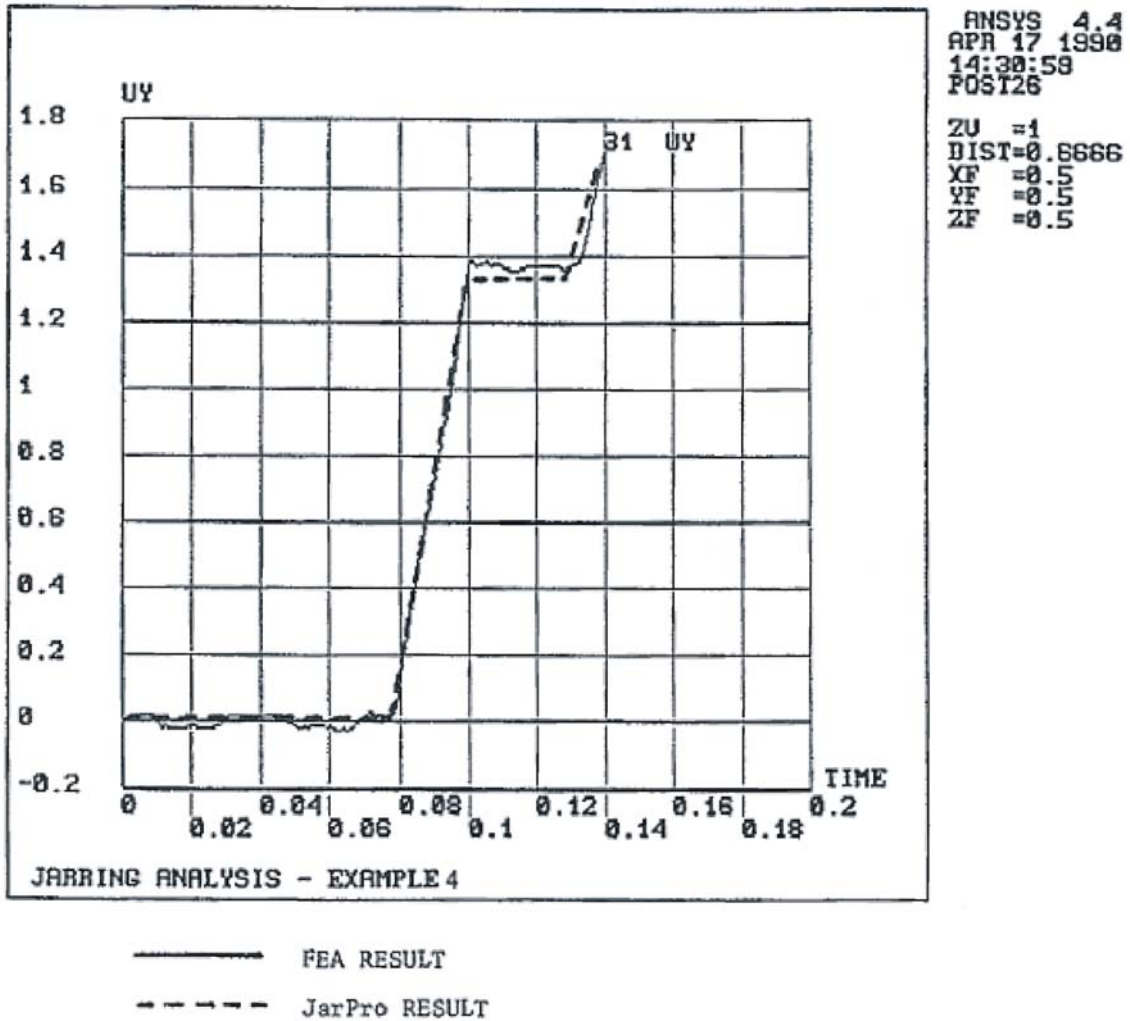
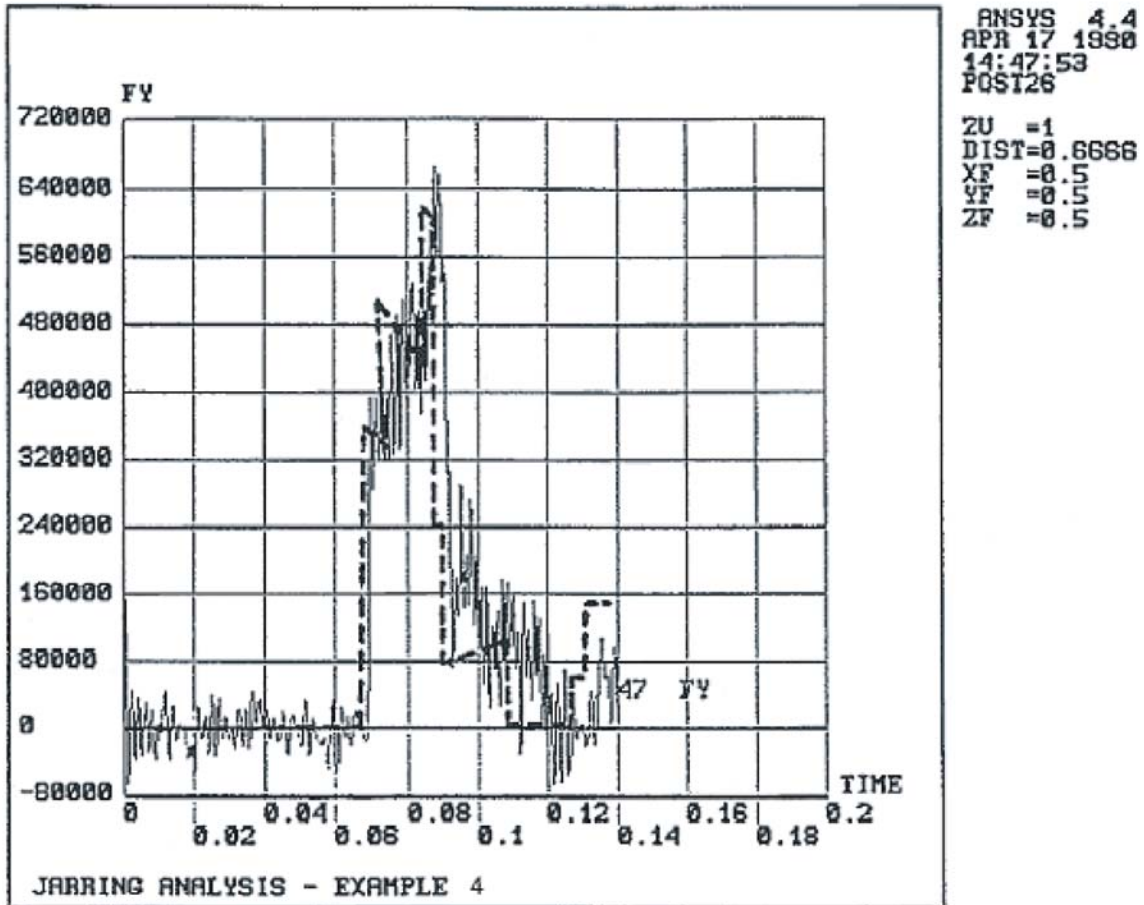


Figure 4.4(d)
Hammer Impact Force Plot, Example 4



———— FEA RESULT
----- JarPro RESULT

Figure 4.4(e)
Stuck Point Force Plot, Example 4

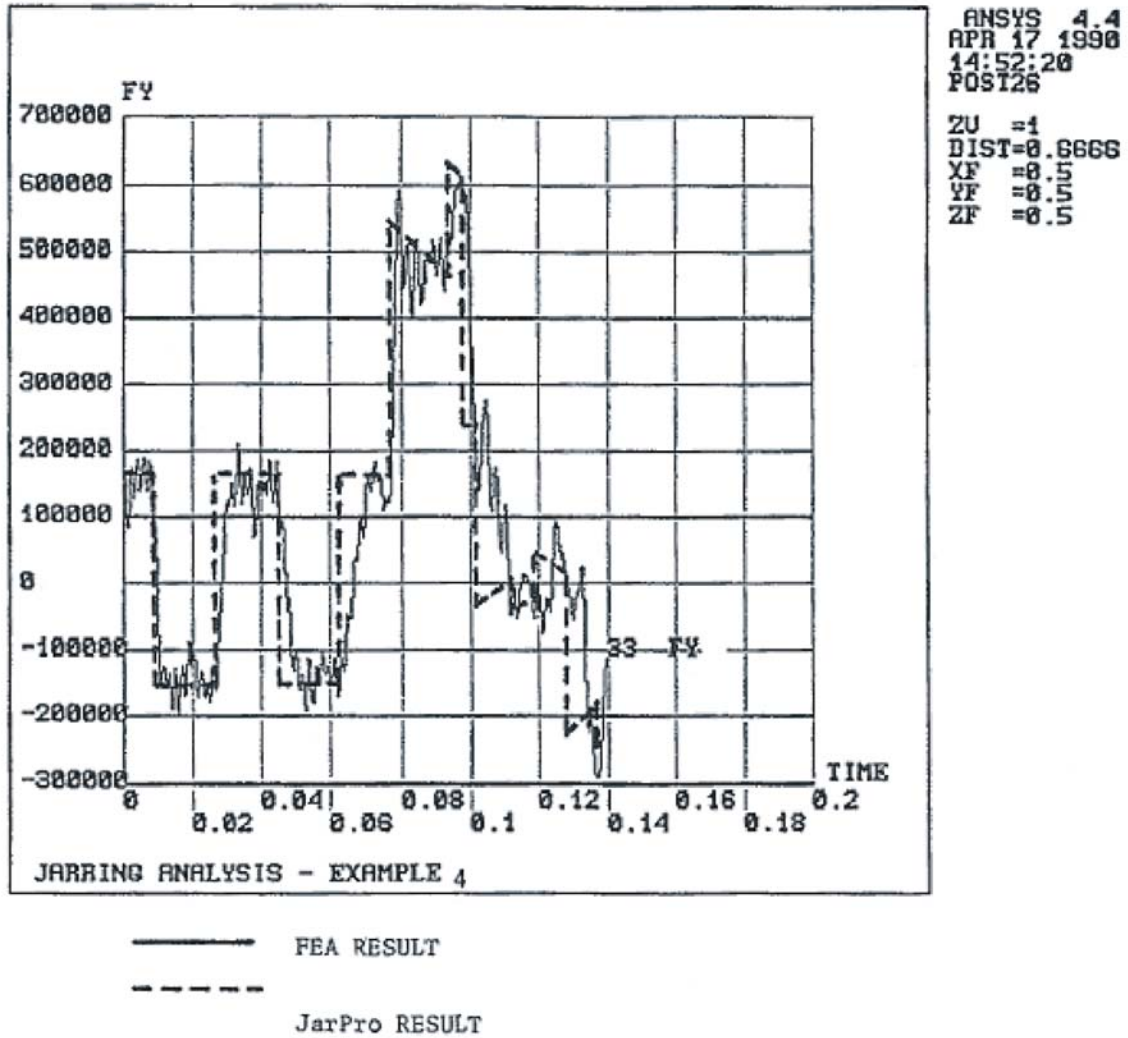


Figure 4.5
 Jar Placement and Friction Effect Plot, Example 6

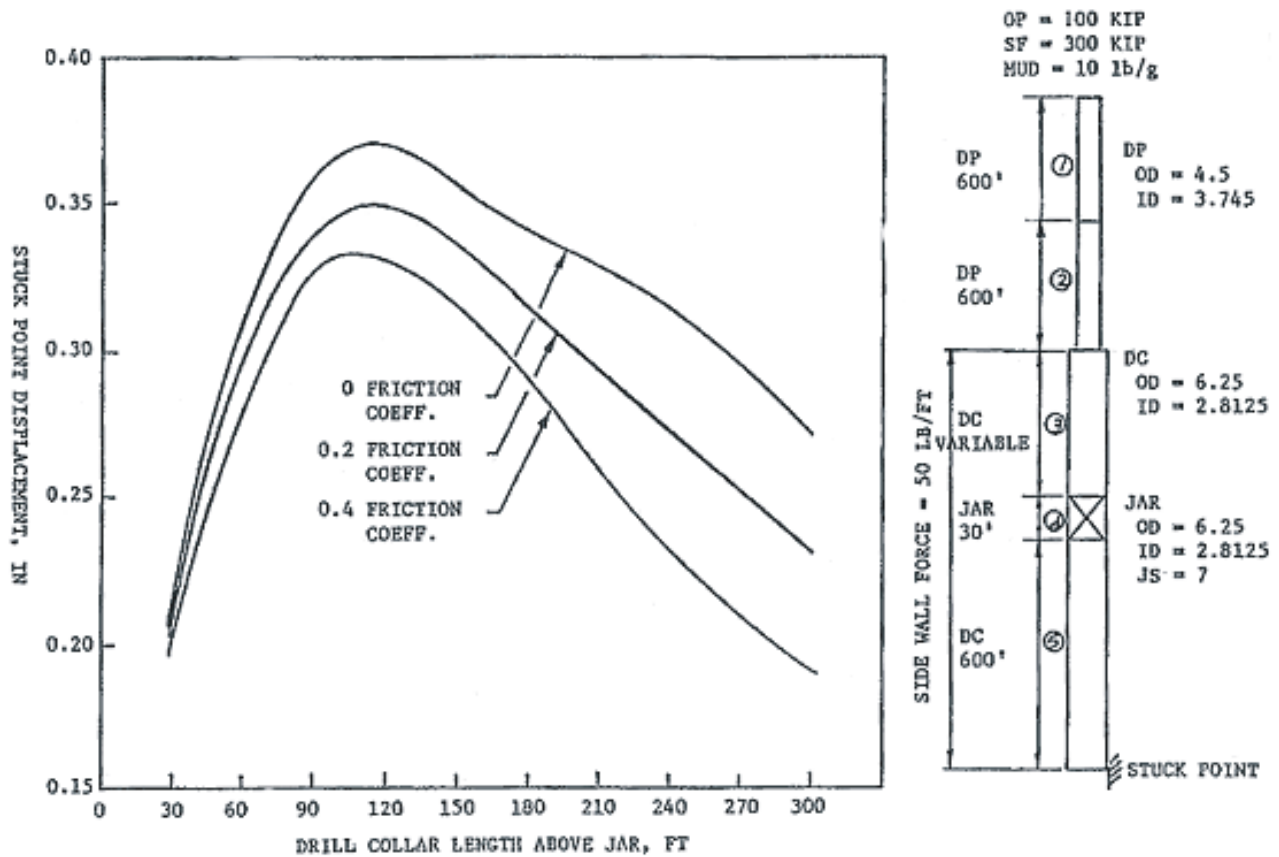


Figure 4.6(a)
A Two-Dimensional Drillstring Assembly, Example 8

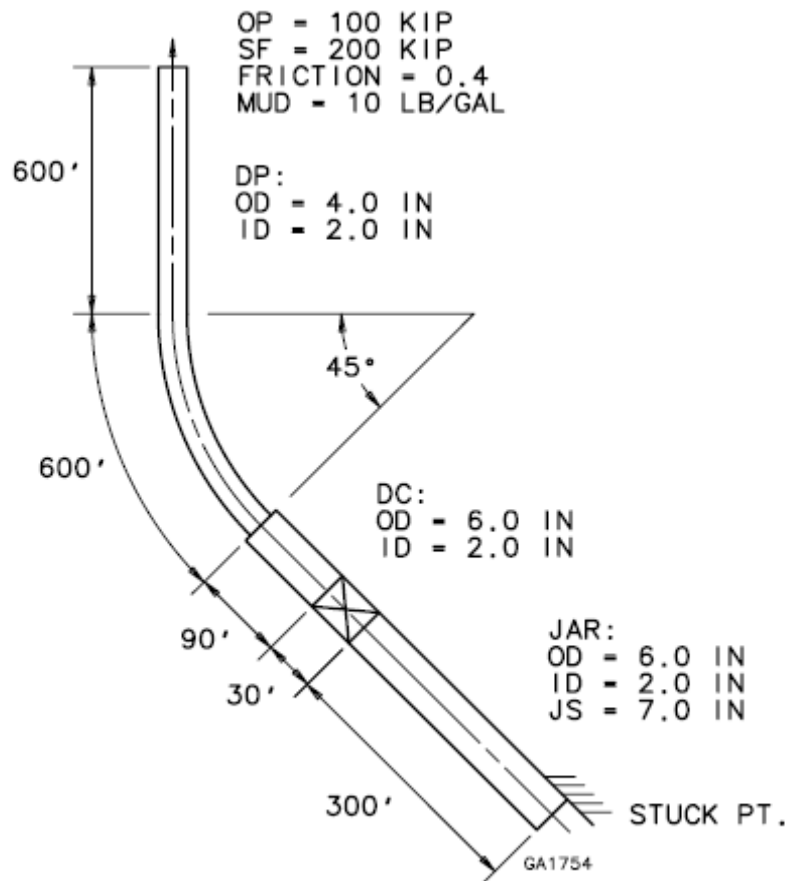


Figure 4.6(b)
Hammer Displacement Plot, Example 8

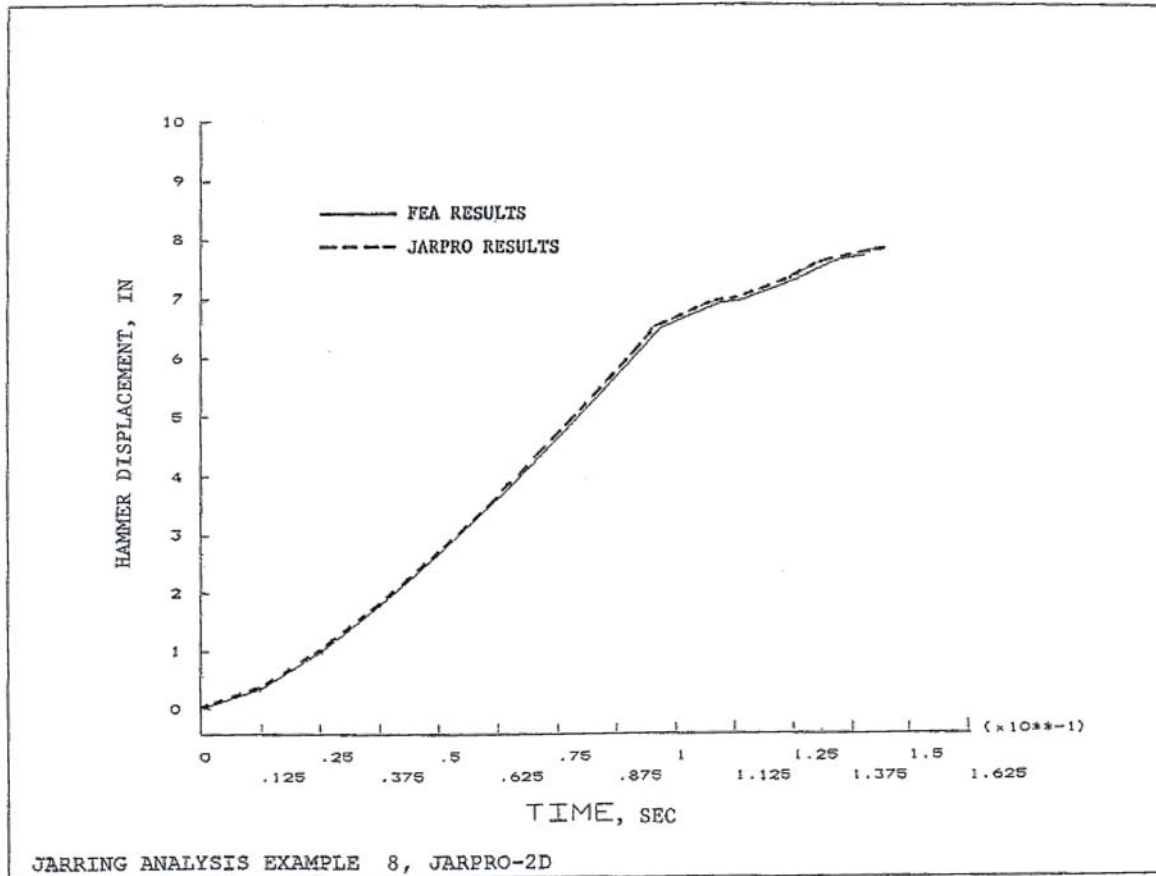


Figure 4.6(c)
Hammer Impact Force Plot, Example 8

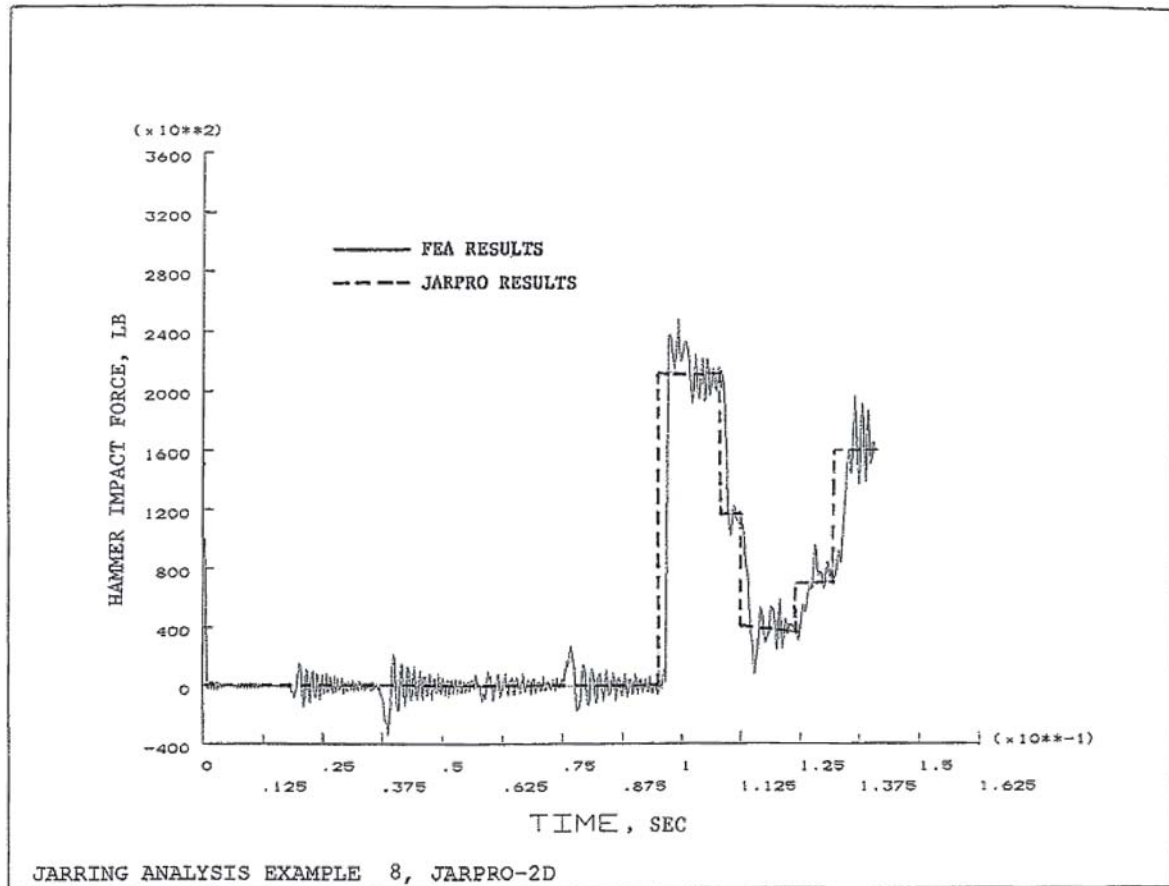


Figure 4.6(d)
Stuck Point Displacement Plot, Example 8

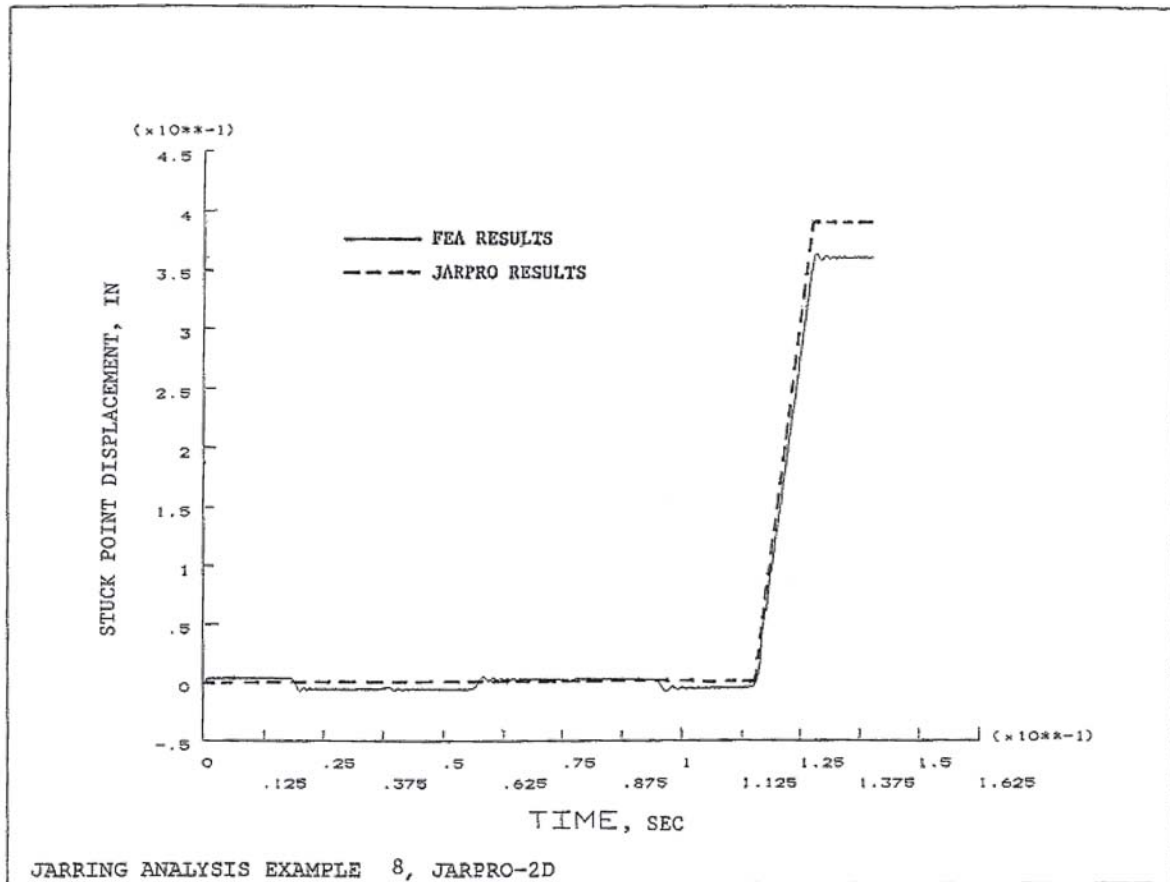


Figure 4.6(e)
Stuck Point Force Plot, Example 8

