4.0 Frequency Analysis

For many designers, determining how quickly the response will follow an oscillation signal is a very important design goal. This is where HyPneu's frequency analysis capability can be used. We understand that frequency analysis is not a critical operation for every user. That we why we provide the Frequency Analyzer as an add-on to the basic HyPneu program. The following examples show how HyPneu's Frequency Analyzer has been used to solve real-life design problems.

4.1 Second Order Mechanical System

Most engineers have learned that the simplest second order mechanical system consists of a spring, a mass, and a damper. The primary parameter of these systems is the natural frequency. Therefore, frequency analysis is an important tool for the system designer. If one assumes that the system involved is linear, then a transfer function can be easily developed for a spring-mass-damper system and the natural frequency can be readily determined. however, suppose that one of the component (e.g., the spring) is non-linear. A transfer function is only appropriate to a linear system and therefore cannot be used where the system includes a non-linear spring.

The spring-mass-damper system can be evaluated by the HyPneu program for both linear and non-linear situations. The schematic shows a system developed in HyPneu which consists of a spring (SM2110), a mass (SM1100) and a damper (SM3110). This system is excited by a pulse (SI4140) which is converted to a force pulse by the CTT component (SI3230). The frequency response of this system with the parameters mass=386.4 LBf, spring rate=100 LBf/in, and damper=6 LBf in/sec is shown by the curves.

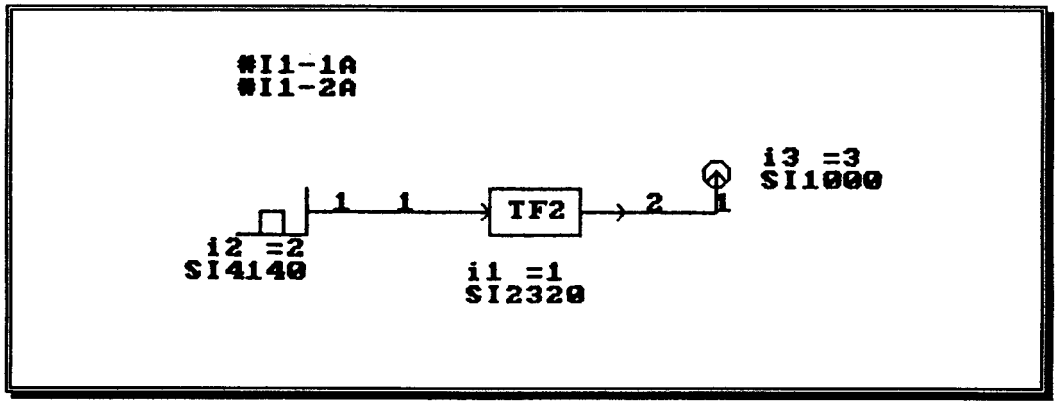

Figure 4.1a. Second Order Mechanical System Schematic.

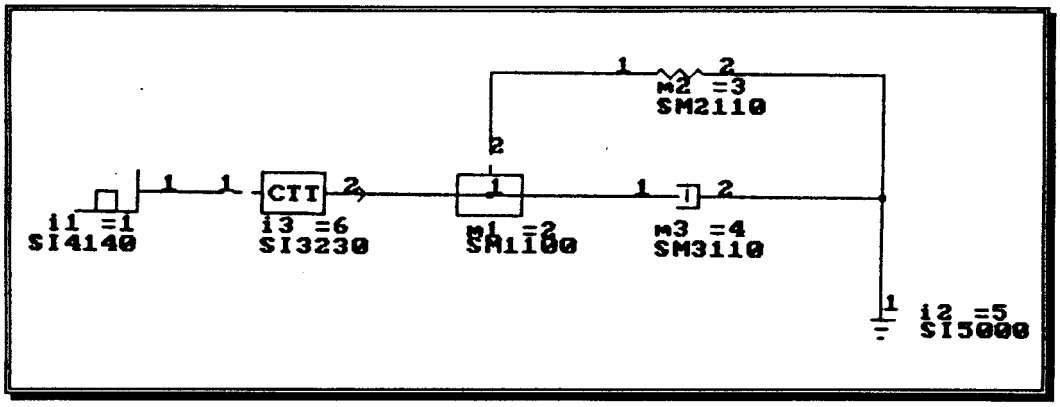

Figure 4.1b. Second Order Mechanical System Schematic.

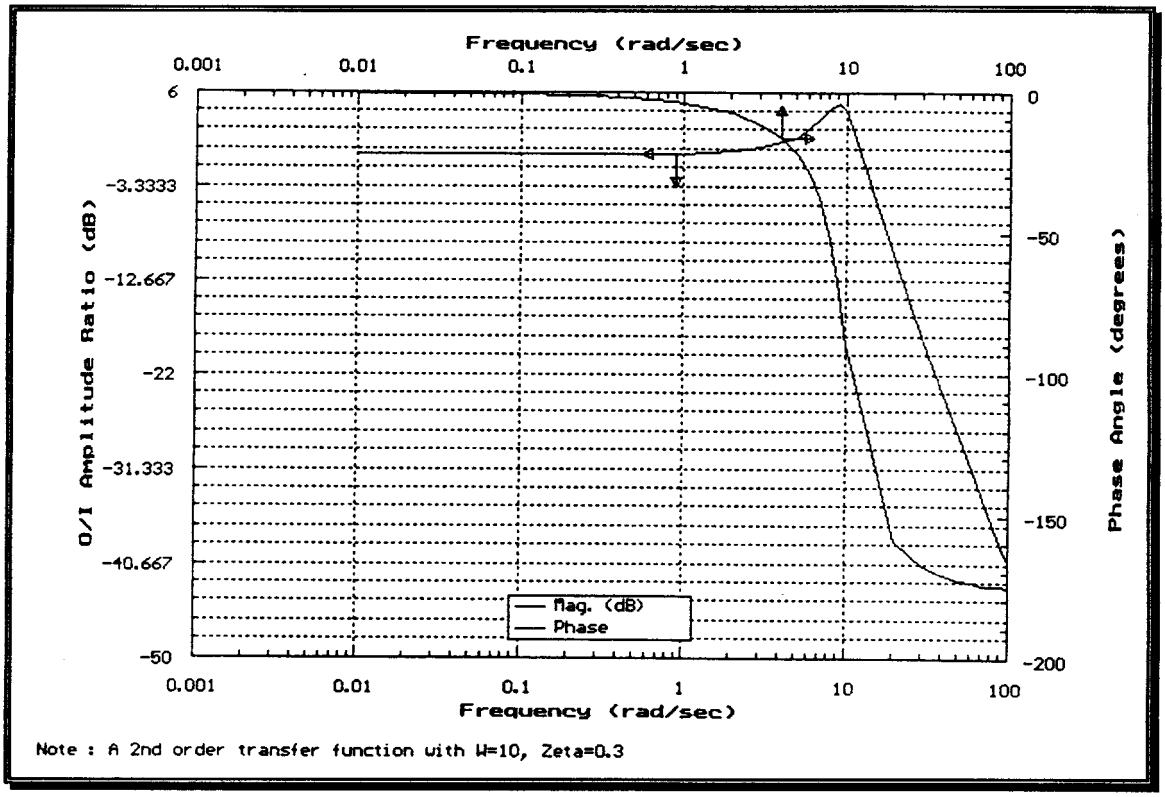

Figure 4.1c. Second Order Mechanical System Analysis.