Create your own asteroid mission

This mission’s main goal is to stop/destroy an asteroid which threats to hit the Earth. We had to send it in this kind of file instead of source code for GMAT because it is more like an idea than like a mission because there is not even need to leave the Earth. We hope you are going to pay attention and check our solution.

It is based on the physics laws, more precisely on resonance. In short, the algorithm is simple.

We have to calculate normal (Eigen) frequency of the asteroid, radiate the asteroid with laser that will shoot electromagnetic waves with same frequency with high intensity, and cause resonance which will transform the asteroid into dust.

The only way to calculate body’s normal frequency is to use eigenvectors and Eigen values.

Eigen value problems occur naturally in the vibration analysis of mechanical structures with many [degrees of freedom](http://en.wikipedia.org/wiki/Degrees_of_freedom_(mechanics)). The Eigen values are used to determine the natural frequencies (or **Eigen frequencies**) of vibration, and the eigenvectors determine the shapes of these vibrational modes. In particular, undamped vibration is governed by

m\ddot x + kx = 0

Where m is mass matrix and k is a [stiffness matrix](http://en.wikipedia.org/wiki/Stiffness_matrix).

Simplest way to observe the object is to consider it as a homogenous mixture. That way we are able to use only one equation with little interval of possible salvations. Solving the equation leads to:

mω2 x – kx = 0

ω=

Two unknown information about the object (asteroid) are its mass and its constant factor characteristic of the spring.

The mass can be found by the usage of photo spectrometers. According to the information we received there is one satellite in use which has photospectrometers. It will give us information of asteroids composition by the spectral image. That will give us information about how many atoms are in that object, what their percentage is which will help to calculate the density. With the use of telescopes the volume of the asteroid can be calculated. From the equation:

m=ρV

we can calculate its approximate mass.

The constant factor characteristic of the spring can be possibly calculated in two ways. First one is using the constant factor characteristic of the spring of the most similar rock that can be found on the Earth which will increase the interval of natural frequency possible values.

The other way is to create more similar model in smaller proportions than those we have already on the Earth and calculate its constant factor characteristic of the spring. That way we can even decrease that interval of possibilities.

mg = kx

Finally we are able to calculate asteroid’s natural frequency (interval of frequencies)

or a solid’s natural frequency, we can ignore the effects of pressure on the material, and the volumetric thermal expansion coefficient can be written as:


\alpha_V = \frac{1}{V}\,\frac{dV}{dT}


where V is the volume of the material, and dV/dT is the rate of change of that volume with temperature.

This means that the volume of a material changes by some fixed fractional amount.

If we already know the expansion coefficient, then we can calculate the change in volume


\frac{\Delta V}{V} = \alpha_V\Delta T


After this we should be able to calculate the amount of energy required to be brought to the asteroid in order to create thermal dilatation of its volume which will act like a sound wave. This sound wave will resonance with the normal frequency of the asteroid and will turn it into dust.