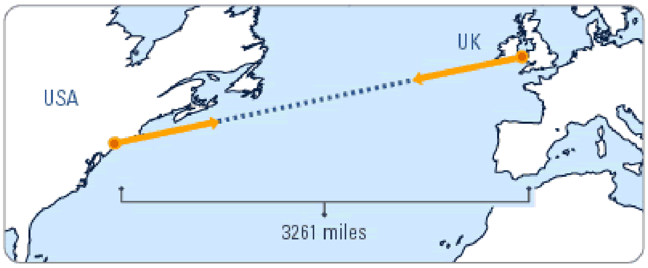
MSc - project

Specialization: **Structural Mechanics**

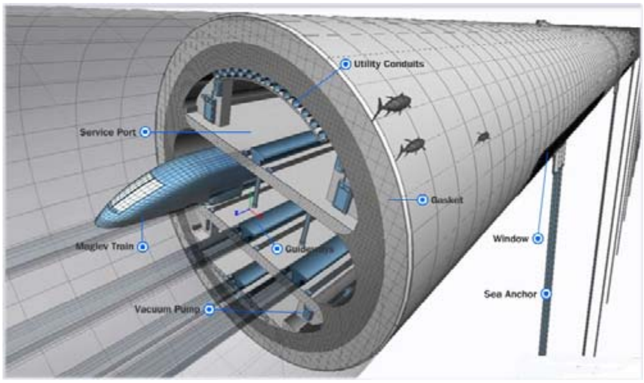
Dynamic Response of the Transatlantic Tunnel to a Hypersonic Train

Introduction

The world is about to witness the dawn of a new era of trans-continental travel. A high-speed train could theoretically take you from New York to London in 54 minutes. But you would have to go 8000 km/h through a 5000 km long tunnel that was itself floating in the Atlantic Ocean. To reach this speed, almost a perfect vacuum would have to be maintained in the tunnel and the train would have to be magnetically levitated. The vacuum and magnetic levitation, however, can not ensure that the tunnel will not vibrate under the passing train. How intense would be these vibrations?

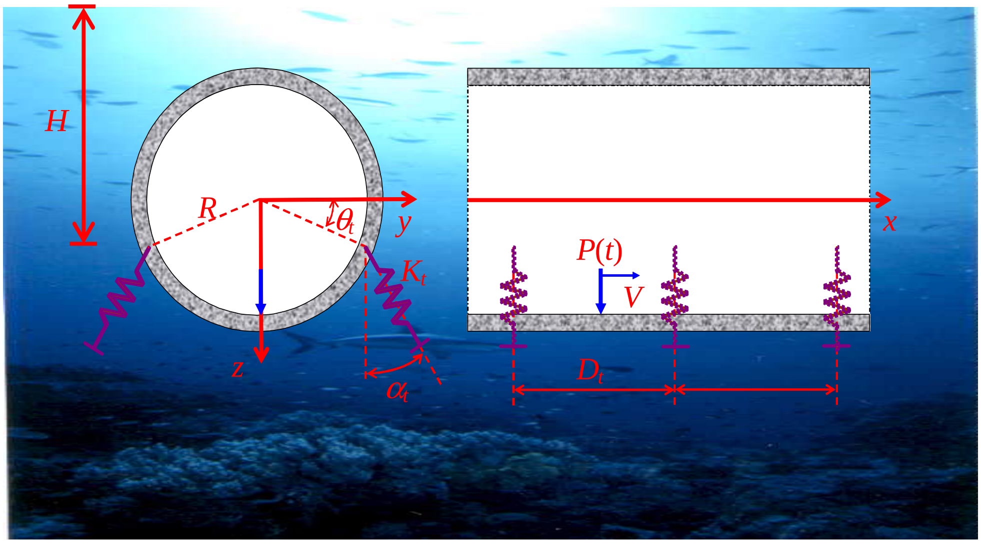


Project Description



The transatlantic tunnel would be built of 54000 prefabricated sections connected by watertight and vacuum-tight gaskets. Each section of tunnel is to be attached to tethers which are to be affixed to an anchor at the see floor, which is, in some places almost 8 km deep. The tunnel would hover at about 45 meter below the see surface, ideal to avoid ships and still minimize pressure and also to sway a bit under pressure.

In this project, the steady-state dynamic response of the tunnel will be studied to a train, which moves hypersonically (8000 km/h). The model shown in the figure below will be used. This model consists of an elastic cylindrical shell (infinitely long) than floats in water and is moored to the seafloor by springs. The motion of the tunnel in water will be described using the Morrison equation for the hydrodynamic drag and the added mass concept. The train will be modelled as a set of uniformly moving loads.



The aim of this project is to estimate the level of the tunnel vibrations induced by the train.

Date:
24 December 2004

Supervisors:

Ir. M. Shamalta
TNO Bouw, room 1.1.12, M.Shamalta@citg.tudelft.nl
Dr. Andrei Metrikine
CT, Structural Mechanics, room 5.37, A.Metrikine@CiTG.TUDelft.NL
http://www.mechanics.citg.tudelft.nl/~andrei_m/