

# *Hydrodynamic cochlear model*

## *Basilar membrane velocity and Intracochlear pressure*

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### **1. File names and functions**

-. Main file lists

- a) eiconal\_JASA.m: Define input parameters (gerbil)/Solve eiconal equation
- b) GB\_Amplitude\_freq.m: Plot basilar membrane velocity vs frequency (magnitude and phase)
- c) GB\_P\_F\_combinedwave.m: Plot intracochlear pressure (Slow wave + Fast wave) vs frequency.
- d) GB\_derived.m: Plot derived quantities vs frequency
- e) Lamda\_plot\_GB.m: Plot wavenumber vs distance from the stapes

-. Sub functions list

- f) Eiconal\_sol.m: Call from eiconal\_JASA.m, generate eiconal equation.
- g) bmpressure.m: Call from GB\_P\_F\_combinedwave.m and GB\_derived.m
- h) comp.m: Call from GB\_P\_F\_combinedwave.m and GB\_derived.m
- i) Requires the Matlab toolbox

### **2. How to run**

-. Wavenumber calculation

- a) Put "Int\_coch\_P" folder in the "C:\MATLAB6p5\work\" directory.
- b) Create "wavenumber" folder under "Int\_coch\_P" folder.
- c) Create your own folder under "wavenumber" folder: ex) passive
- d) Run eiconal\_JASA.m → Generate wavenumber for each frequency

-. Interesting results plot

- a) Run Main files to plot → BM velocity and derived quantities vs frequency.

### **3. Reference**

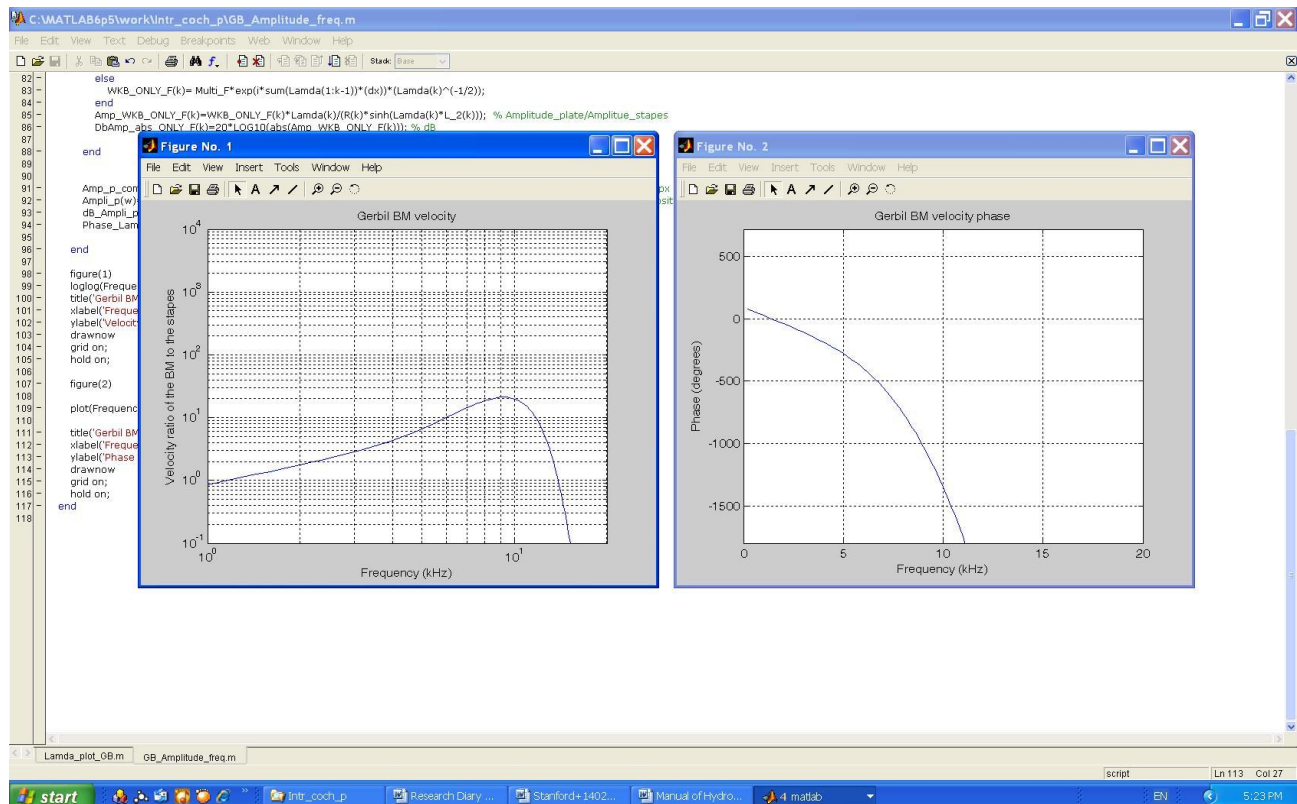
- a) Yong-Jin Yoon, Sunil Puria, and Charles R. Steele, "Intracochlear pressure and derived quantities from a three-dimensional model", J. Acoust. Soc. Am. 122 (2), 952-966. (2007)
- b) <https://simtk.org/home/otobiomech>

## 4. Examples

### Ex. 1) BM velocity vs frequency

- i) Do 2.a) through 2.d) to generate wavenumber for each frequency.
- ii) Run (F5) GB\_Amplitude\_freq.m: Details are in the m file comment.
- iii) Set x and y ranges from Matlab figure module

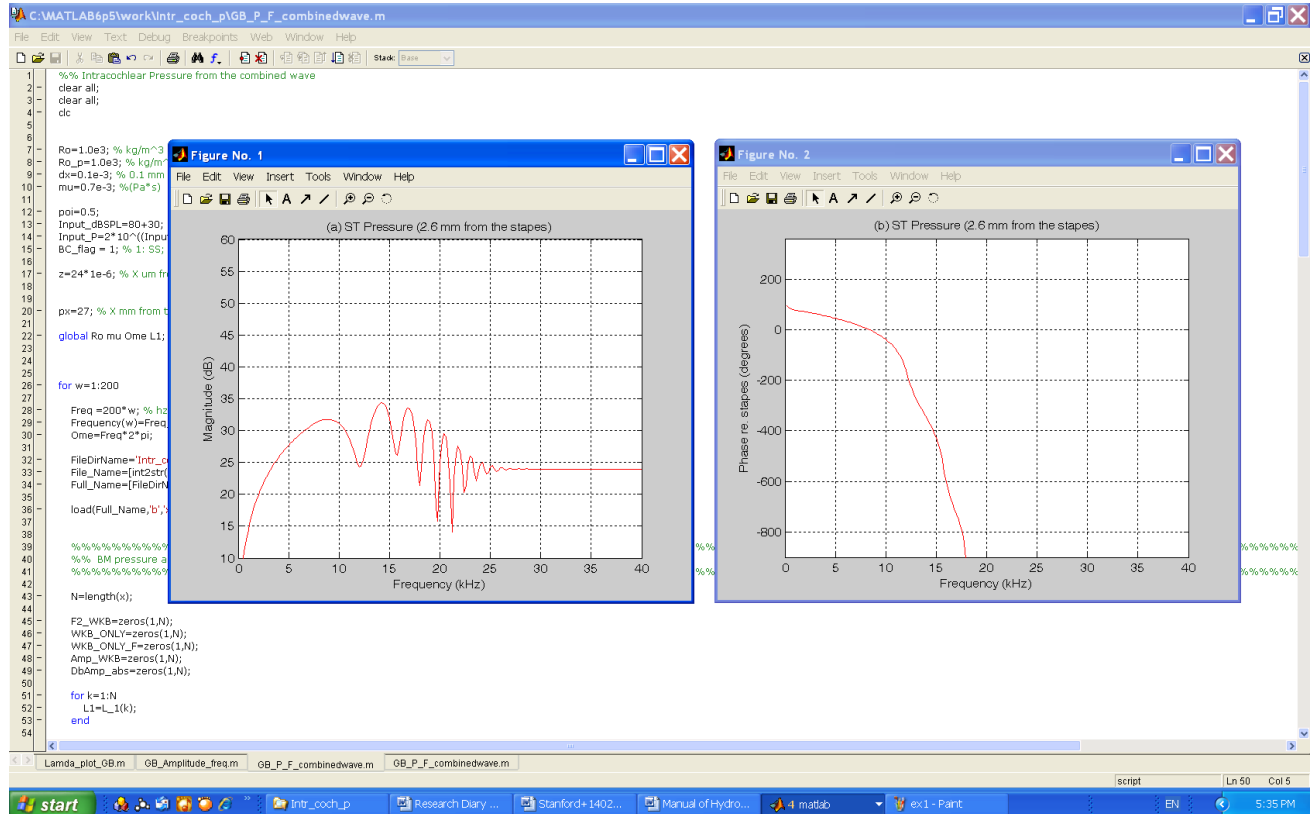
Results on your screen will be same as JASA Fig. 4a and 4b:



## Ex. 2) Scala tympani intracochlear pressure vs frequency

- i) Do 2.a) through 2.d) to generate wavenumber for each frequency.
- ii) Run (F5) GB\_P\_F\_combinedwave.m: Details are in the m file comment.
- iii) Set x and y ranges from Matlab figure module

Results on your screen will be same as JASA Fig. 6c and 6d:



### Ex. 3) Derived quantities ( $V_{bm}$ , $\Delta P_{oc}$ , and $Z_{oc}$ ) vs frequency

- i) Do 2.a) through 2.d) to generate wavenumber for each frequency.
- ii) Run (F5) GB\_derived.m: Details are in the m file comment.
- iii) Set x and y ranges from Matlab figure module

Results on your screen will be same as JASA Fig. 8c and 8d, Fig 9c and 9d, and Fig 10c and 10d:

