Instruction to run the GUI-based Matlab program package: ZBS-DWBA

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Objective:

The program package is to compute the backscattering as a function of frequency or angle of a weakly scattering deformed fluid cylinder, either uniformly bent or arbitrary profile defined by the user. The model is based on the Distorted Wave Born Approximation (DWBA).

Operation:

1. Go to the ZBS-DWBA home directory
2. Run the main program by typing "start_bscat" in the Matlab Command Window
3. A GUI window should appear and the then define the target & simulation parameters (described in the Parameter Description section below) from the GUI window.
4. Click the "Start" button to run the program
5. You can save the configuration (all the defined parameters) by click on "Save Config" button and providing a configuration filename. You can load the saved Config file next time if you want the save parameters.
6. You can also save the outputs by clicking on the "Save" button and providing an output filename.

Parameter Description:

Shape

Length (mm): body length in mm

rho/L: rho is the radius of curvature (assume uniformly bent cylinder) and L is the body length of the elongated body; rho/L is the ratio of the two parameters. When rho/L approaches infinity, the target will be a straight cylinder.

L/a: a is the radius of the mid-point of the cylinder; L/a is the ratio of the two parameters.

Taper order: a parameter control the tapering: $r(z) = a\sqrt{1-(2z/L)^n}$, where $z = [-L/2 \quad L/2]$, and n is the taper order. For a straight cylinder (rho/L $\to \infty$), $n = 2$ results in a prolate spheroid if L > 2a and an oblate spheroid if L < 2a.

If "Length Average" option is checked, the average over length will be performed:

std(L)/<L>: the ratio of the standard deviation of length to the mean length. Note the display on the GUI window is wrong, should be std(L)/<L> instead of Std(L/<L>) although there are identical mathematically.

If "Profile" option is checked, the user will provide a profile of the shape of the target using the "browse" button. The profile is a plain text file and has 3 or 5 columns (examples of these files ar ein the profile directory):

X Z R Xupper Xlower

where X and Z are the center coordinates of each circular segment, and R is the radius of each circular segment. Z is the axis along elongation direction. The Xupper and Xlower are $X \pm R$, i.e. upper and lower boundary of the zooplankton target. The last two columns are not necessary needed for computing the backscattering. A few examples of copepods and euphausiids are given in the directory of "shape_profiles".

Taper Smooth: filter length to smooth the radius, i.e. R (value of 1 means no smoothing).
Axis Smooth: filter length to smooth the body axis, i.e. (X, Z).

Orientation

<mean theta>: mean angle of orientation in degree
Begin theta: minimum angle for uniform probability density function (PDF)
End theta: maximum angle for uniform probability density function (PDF)

If "Orientation Average" option is checked, average over angle of orientation will be performed:

Uniform PDF: uniform PDF with angle range defined by "Begin theta" and "End theta".

Gaussian PDF: a Gaussian PDF will be used with the mean angle of orientation defined by "<mean theta>" and following two parameters:

std(theta): standard deviation of the angle of orientation and the computation range is [<mean theta> - 3*std(theta) <mean theta> + 3*std(theta)].

Theta Increment: angle increment when averaging is performed.

Material Property:

For a homogenous target:

Density contrast: ratio of the density of animal to that in the surrounding fluid
Sound speed contrast: ratio of the sound speed in animal to that in the surrounding fluid

If "inhomogenous body" option is checked, the scattering target will have an inhomogeneous body with the following parameters (the mean *g* and *h* are chosen from the "Density contrast" and "Sound speed contrast" defined above the checkbox):

No of Seg: no of segments with different *g* and *h* along the body axis.
std(g): standard deviation of density contrast, *g*.
std(h): standard deviation of sound speed contrast, *h*.
Correlation length (% of body length): this parameter is used only when the "No. of Seg" is greater than 8. It controls variability of the *g* and *h* along the body axis. It defines a larger variability around mid-section and a smaller variability at both ends. This "Correlation length" is the standard deviation of a Gaussian function centered at the mid-section of the body. Two examples of 7 and 10 segments are given in the directory of "gh_profiles".

Simulation:

Output (drop-down menu): selection of the output quantity: backscattering amplitude, differential backscattering cross section; Target strength (dB); Reduced Target Strength (dB)

Variable (drop-down menu): selection of the variable: frequency (kHz); Angle (deg); *ka*, where k is the wave number and *a* is the determined from the two parameters "Length" and "L/a".

Sample points: number of output variable and computed quantity points.
Integration points: number of integration points along the elongated body axis.
Variable start value & Variable end value: start and end values of the variable chosen from the "Variable" drop-down menu.

Output:

The output structures "para" and "dat" can be saved to a –mat file:

Structure "para" has information on

- Info – working directory
- shape – Target geometric shape
- orient – Target orientation
- phy – Target physical material properties
- simu – Simulation parameters

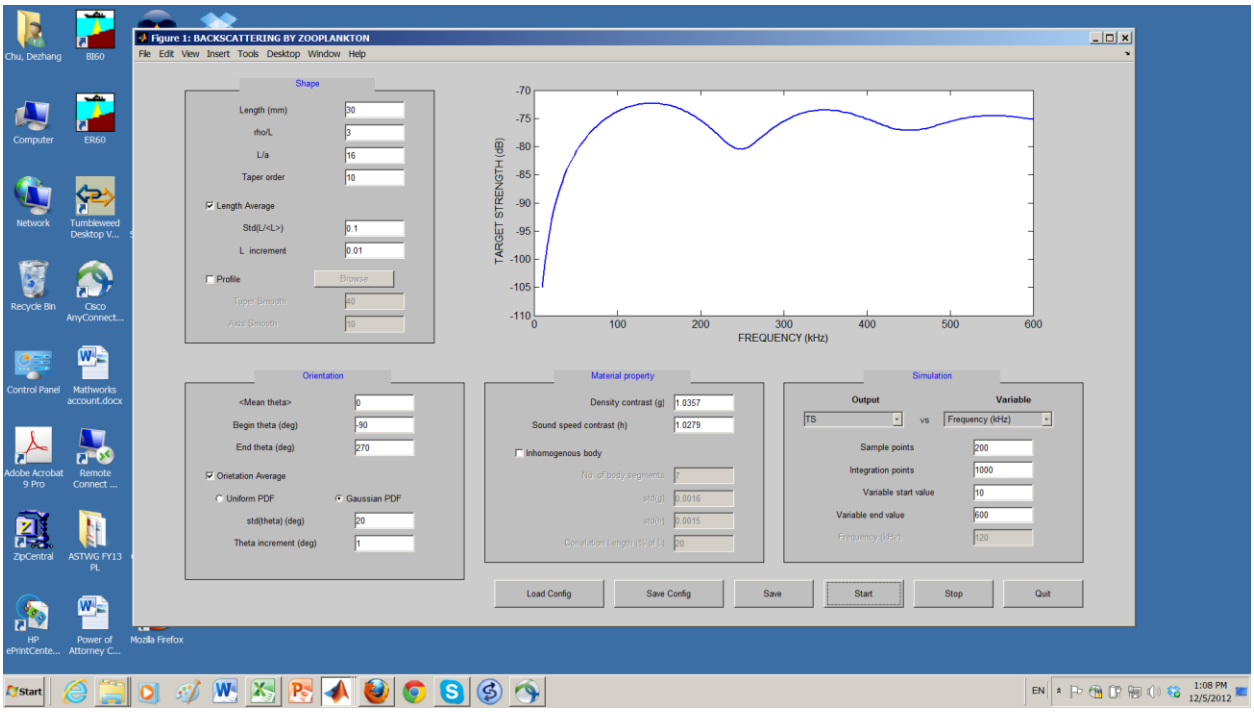
Structure "dat" has two variables:

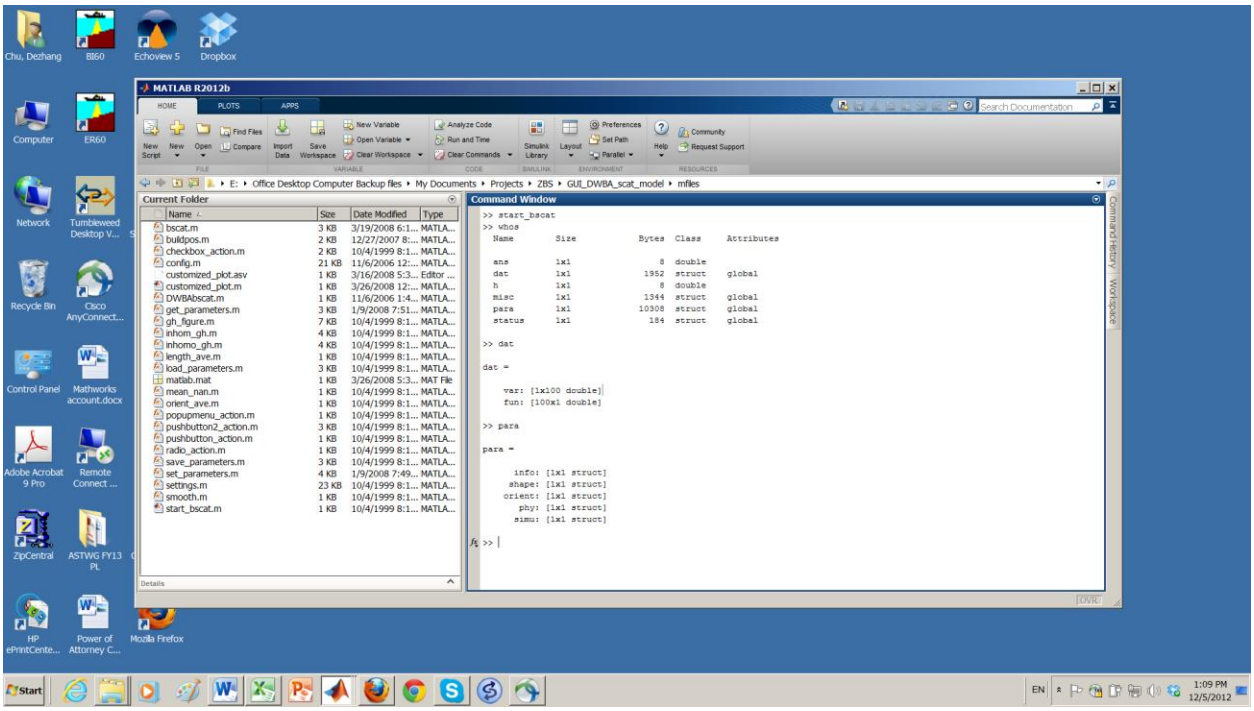
- var – frequency, angle, or *ka*
- fun – backscattering amplitude, backscattering differential cross section, target strength, or reduced target strength

Configuration:

Save and load specific configurations, or setups by click on “Save Config”/”Load Config” buttons on the GUI window. Two examples are given in the directory of “configuration”.

Example:




MATLAB R2012b
HOME
PLOTS
APPS
Search Documentation
New Script
New
Open
Find Files
Compare
Import Data
Save Workspace
New Variable
Open Variable
Clear Workspace
Analyze Code
Run and Time
Clear Commands
Simulink Library
Layout
Preferences
Set Path
Parallel
Help
Community
Request Support
FILE
VARIABLE
CODE
SIMULINK
ENVIRONMENT
RESOURCES
E: ▸ Office Desktop Computer Backup files ▸ My Documents ▸ Projects ▸ ZBS ▸ GUI_DWBA_scat_model ▸ mfiles
Current Folder
Name
Size
Date Modified
Type
bscat.m 3 KB 3/19/2008 6:1... MATLA...
buildpos.m 2 KB 12/27/2007 8:... MATLA...
checkbox_action.m 2 KB 10/4/1999 8:1... MATLA...
config.m 21 KB 11/6/2006 12:... MATLA...
customized_plot.asv 1 KB 3/16/2008 5:3... Editor ...
customized_plot.m 1 KB 3/26/2008 12:... MATLA...
DWBAbscat.m 1 KB 11/6/2006 1:4... MATLA...
get_parameters.m 3 KB 1/9/2008 7:51... MATLA...
gh_figure.m 7 KB 10/4/1999 8:1... MATLA...
inhom_gh.m 4 KB 10/4/1999 8:1... MATLA...
inhomo_gh.m 4 KB 10/4/1999 8:1... MATLA...
length_ave.m 1 KB 10/4/1999 8:1... MATLA...
load_parameters.m 3 KB 10/4/1999 8:1... MATLA...
matlab.mat 1 KB 3/26/2008 5:3... MAT File
mean_nan.m 1 KB 10/4/1999 8:1... MATLA...
orient_ave.m 1 KB 10/4/1999 8:1... MATLA...
popupmenu_action.m 1 KB 10/4/1999 8:1... MATLA...
pushbutton2_action.m 3 KB 10/4/1999 8:1... MATLA...
pushbutton_action.m 1 KB 10/4/1999 8:1... MATLA...
radio_action.m 1 KB 10/4/1999 8:1... MATLA...
save_parameters.m 3 KB 10/4/1999 8:1... MATLA...
set_parameters.m 4 KB 1/9/2008 7:49... MATLA...
settings.m 23 KB 10/4/1999 8:1... MATLA...
smooth.m 1 KB 10/4/1999 8:1... MATLA...
start_bscat.m 1 KB 10/4/1999 8:1... MATLA...
Details
Command Window
>> start_bscat
>> whos
Name Size Bytes Class Attributes
ans 1x1 8 double
dat 1x1 1952 struct global
h 1x1 8 double
misc 1x1 1344 struct global
para 1x1 10308 struct global
status 1x1 184 struct global
>> dat
dat =
var: [1x100 double]
fun: [100x1 double]
>> para
para =
info: [1x1 struct]
shape: [1x1 struct]
orient: [1x1 struct]
phy: [1x1 struct]
simu: [1x1 struct]
>>
Command History - Workspace
OVR
Chu, Dezhang
Bl60
Echoview 5
Dropbox
Computer
ER60
Network
Tumbleweed Desktop V...
Recycle Bin
Cisco AnyConnect...
Control Panel
Mathworks account.docx
Adobe Acrobat 9 Pro
Remote Connect ...
ZipCentral
ASTWG FY13 PL
HP ePrintCente...
Power of Attorney C...
Mozilla Firefox
Start
EN
1:09 PM
12/5/2012