**RPHIIItools. Matlab functions in the supplementary web site for the**

**Rock Physics Handbook, 3rd Edition, by Mavko, Mukerji, and Dvorkin, 2020**

**AVO**

avo\_abe - Shuey’s AVO approximation for AVO.

avopp - P-to-P AVO; single interface; Zoeppritz & approximations.

avops - P-to-S AVO; single interface; Zoeppritz & approximations.

Rorsym - Calculates the reflectivity in the symmetry plane for interfaces between orthorhombic media

Rruger - Reflectivity AVOZ in weakly anisotropic media

Rvavrycuk - Calculates P-P reflectivity at interface between two materials with weak arbitrary anisotropy

**CROSS RELATIONS and SOLID SUBSTITUTION**

Cond\_crossbound\_manager- wrapper to call programs for cross bounds of electrical conductivity and bulk modulus

Embbound\_bulk - Solid substitution for bulk modulus.

Embbound\_bulk\_Dub - Solid substitution for bulk modulus, where both phases can change.

Embbound\_shear - Solid substitution for shear modulus.

Embbound\_shear\_Dub - Solid substitution for shear modulus, where both phases can change.

gibiansky\_torquato\_crossbounds - Gibiansky-Torquato electrical-elasticity cross bounds

KS\_GT\_mtrends - Computes Gibiansky-Torquato conductivity-elasticity cross bounds.

KS\_inclusion\_plotsB - Superimposes DEM and SCA inclusion models onto the Gibiansky-Torquato electrical-elasticity cross bounds

Solidsquirt - Solid substitution equivalent of the squirt model

Solidsquirt\_uf - Solid substitution equivalent of the squirt model, unrelaxed frame

Solidsub - Solid substitution lower bound – generalized Gassmann

Pwavesub - Solid substitution of P-wave modulus, without knowledge of shear modulus.

runGandT - Computes Gibiansky-Torquato elastic-electrical cross bounds.

runGandT4 - Computes Gibiansky-Torquato elastic-electrical cross bounds bounds.

**EFFECTIVE MEDIUM, ELASTIC**

berrysc - Effective elastic moduli using Berryman's Self-Consistent approximation

berryscm - Effective elastic moduli for multi-component (n>2) composite using Berryman's Self-Consistent

berryscp - Effective elastic moduli vs. pressure for multi-component media using Berryman's Self-Consistent

bkus - Backus average for thin layered TI anisotropy

bkusc - Backus average for thin layered TI anisotropy

bkuslog - Backus average of segment of well log

bound - Voigt-Reuss & Hashin-Shtrikman elastic bounds

bounds - Voigt-Reuss & Hashin-Shtrikman elastic bounds

c2anis - Compute Thomsen parameters from VTI Voigt notation matrix

c2sti - Converts VTI elastic stiffnesses to elastic compliances

c2vti - Computes Vp, Vsh, and Vsv at any direction in a VTI material

CSiso - Creates Voigt notation compliance and stiffness matrices for isotropic material

cti2v - Computes Vp and Vs in the fast and slow directions of VTI material

Cem - Computes modulus-porosity trends from Dvorkin’s contact cement model

dem - Effective elastic moduli using Differential Effective Medium approximation

critpor - Velocities, density, and moduli at critical porosity

dem1 - Effective elastic moduli using Differential Effective Medium model

dem\_anisoC - Anisotropic Differential Effective Medium, with aligned spheroidal inclusions

dem\_gm - DEM - Effective elastic moduli using Differential Effective Medium

demyprime - f\Function called by the DEM programs

echeng - Eshelby-Cheng VTI model for aligned spheroidal inclusions

hash - Hashin-Shtrikman upper and lower bound effective moduli

hashv - Hashin-Shtrikman upper and lower bound velocities

hertzmind - Computes bulk and shear moduli of a dry elastic sphere pack using Hertz-Mindlin

hertzmindv - Computes P- and S-wave velocities of dry elastic sphere pack using Hertz-Mindlin

hudson - Computes effective elastic moduli of rock with single set of aligned cracks, Hudson model

hudson1 - Computes effective elastic moduli of rock with single set of aligned cracks, Hudson model

hudson3 - Computes effective elastic moduli of rock with three perpendicular sets of cracks, Hudson model

hudsoncone - Computes effective elastic moduli with crack normals randomly distributed at fixed angle of symmetry.

hudsonF - Computes effective elastic moduli with crack normals oriented with Fisher distribution

HSaverageB - Hashin-Shtrikman elastic bounds

John\_Makse - Effective elastic moduli with uniaxial strain of a random sphere pack. Makse correction to Norris-Johnson

Johnson - Effective elastic moduli with uniaxial strain of a random sphere pack. Norris-Johnson model

ku2v - Isotropic elastic velocities from input elastic constants

lm2v - Isotropic elastic velocities from input elastic constants

moritanaka - Mori-Tanaka method for effective elastic moduli for multi-component composite

sca\_aniso - Self-consistent approximation for moduli with a single set of aligned ellipsoidal inclusions

Unconsol - Soft sand model – modified lower Hashin-Shtrikman curve with Hertz-Mindlin end points

v2cti - VTI Elastic stiffness from velocities at angles 0, 45, and 90 degrees from the symmetry axis

v2ku - Isotropic moduli computed from Vp, Vs, and density

v2lm - Isotropic moduli computed from Vp, Vs, and density

walton - Buik and shear moduli of a sphere pack using Walton’s model

waltonv - Velocities in a sphere pack using Walton’s model

**EFFECTIVE MEDIUM, ELECTRICAL**

cond\_aligned\_inclusion\_dem - VTI electric conductivity resulting from single set of aligned cracks; DEM approximation

cond\_aligned\_inclusion\_scm - VTI electric conductivity resulting from single set of aligned cracks; SCA approximation

cond\_Bruggeman\_polarized - Bruggeman conductivity model, random inclusions

cond\_iso\_inclusion\_CM - Effective dielectric constant using Clausius Mosotti approximation

cond\_iso\_inclusion\_dem - Effective electrical conductivity using differential effective medium model of spheroidal inclusions

cond\_iso\_inclusion\_scmB - Effective electrical conductivity using the self-consistent approximation of spheroidal inclusions

cond\_iso\_shells\_scm - Effective electrical conductivity for concentric spherical shells

demyprime\_cond\_Bruggeman\_polarized – program called by cond\_Bruggeman\_polarized

demyprimeN\_cond\_aligned - program called by DEM model for aligned ellipsoidal inclusions

demyprimeN\_cond\_iso - program called by DEM model for randomly oriented inclusions

Rfactor\_cond\_iso - Computes the electric field concentration tensor, R, for a spheroidal inclusion

HSaverageCondB - Hashin-Shtrikman bound on effective electrical conductivity

**FLUID PROPERTIES AND FLUID SUBSTITUTION**

BKc2c - Brown-Korringa fluid substitution in terms of Voigt notation stiffnesses

BKd2s - Brown-Korringa dry to saturated fluid substitution in terms of Voigt notation compliances

BKs2d - Brown-Korringa saturated to dry fluid substitution in terms of Voigt notation compliances

BKs2s - Brown-Korringa fluid substitution in terms of Voigt notation compliances

bkti - Brown-Korringa fluid substitution

co2prop - CO2 properties vs. Temperaturę and Pressure

gassmnk - Gassmann fluid substitution of elastic bulk modulus

gassmnv - Gassmann fluid substitution expressed as velocities

flprop - Batzle-Wang relations for reservoir fluid properties

flpropui - GUI to calculate Batzle-Wang relations for reservoir fluid properties

FluidSubMultiMineral - Gassmann fluid substitution with average of multiple minerals

mmti - Wet unrelaxed frame of VTI rock using squirt model

**PERMEABILITY**

BernabeE - Predicts permeability and porosity in rock with pressure-dependent pores and cracks

Bloch - Predicts permeability and porosity in sandstone.

CoatDum - Coates-Dumanoir equation for permeability from porosity and irreducible water saturation

Coates - Equation for predicting permeability from porosity and irreducible water saturation

FredrichE - Predicts permeability from porosity and formation factor

KozCarmE - Original Kozeny-Carman relation for permeability

ModKozCarm - Generalization of Kozeny-Carman in terms of pore diameter, geometric factor, porosity, and percolation porosity

Owolabi - Predicts permeability in unconsolidated sands of Eastern Niger delta

PandaLake - Predicts permeability in terms of tortuosity and particle size distribution extending Kozeny-Carman

PandaLakeKCE - Predicts the effect of cement on permeability

PermMenu - Wrapper to call other permeability predictors

Timur - Predicts permeability from porosity and irreducible water saturation

Tixier - Empirical prediction of permeability in unconsolidated sands of Eastern Niger delta

WylGregE - Predicts permeability from porosity and specific surface area

**SYNTHETIC SEISMIC TRACES**

eimp - Predicts elastic far-offset elastic impedances for P-to-P and P-to-S

eimp2 - Predicts elastic far-offset elastic impedances for P-to-P and P-to-S

ezseis - Quick approximate synthetic seismic traces from low-pass filtering of reflectivity sequence

iatrib - Estimates instantaneous seismic attributes from an image

kenfdisp - Kennet-Frazer algorithm to predict velocity vs. Frequency in normal-incidence layered earth

kenfrtt - Kennet-Frazer algorithm to predict normal incidence travel time in layered earth

kennet - Synthetic seismograms for plane wave, normal incidence propagation

kennett\_aux - Synthetic seismograms for plane wave, normal incidence propagation

rtcdppp - Synthetic ray-trace P-to-P seismic section in a 1D layered earth model

rtcdpppQ - Synthetic ray-trace P-to-P seismic section with Q in a 1D layered earth model

rtcdpps - Synthetic ray-trace P-to-S seismic section in a 1D layered earth model

rtcdppsQ - Synthetic ray-trace P-to-S seismic section with Q in a 1D layered earth model

rtppaniso - Synthetic ray-trace P-to-P seismic section in a 1D layered earth model with VTI layers

sourcewvlt - Generates Claerbout’s minimum phase wavelet

sourcewvlt\_gary - Generates Claerbout’s minimum phase wavelet

pgator - Propagator matrix method for synthetic seismograms for plane wave, normal incidence propagation

**UTILITIES**

bayesclass - Bayes classification based on pdf

blockav - Block average of logs or signals

cbtitle - puts a title on a colorbar, analogous to title.m

ezbond - coordinate transformation of elastic matrix in Voigt notation

fftplot - plot amplitude and phase spectrum of time series.

fillnan - replaces NANs in a vector using a variety of interpolators

find\_dependencies - Generates a dependency report for a single function

ft1axis - Fourier Transform in time axis(column-wise).

ft2axis - Fourier Transform in space axis(row-wise).

hist2d - 2 Dimensional Histogram.

hist3d - 3 Dimensional Histogram.

interpnext - a form of interpolation that chooses the next existing value rather than an average of multiple values

loadlas - Reads well-log .las file and puts curves into a Matlab structure

monte - Monte-Carlo draws from non-parametric marginal cdf followed by linear regression

monteccdf - Monte-Carlo draws from non-parametric conditional cdfs

outputdlg - folder of calls for quick change of markersize and fontsize in an existing plot

pdfbayes - Non-parametric pdf estimation, Bayes' error & Information

radiodlg - created a dialog box with radio buttons, somewhat analogous to inputdlg.m

scatterqq - alternative to scatter plot

shortcuts folder - folder of calls for quick change of markersize and fontsize in an existing plot

**VISCOELASTICITY AND DISPERSION**

biot - Velocity dispersion and attenuation from Biot theory

biothf - High frequency limiting velocity from Biot theory

biothfb - Approximate high frequency limiting velocity from Biot theory

patchw - White's patchy model with Dutta-Ode correction

squirt - Mavko squirt model for high frequency saturated velocities

stdlin - Standard linear viscoelastic solid

viscoelastic - Creates dispersion curves for common viscoelastic models