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% Building multifracturerRock models with 2 fracture families and two infills:

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% Define rock andd fracture parameters for elastic medium/rock models:

                vf1 = 0.80;     % used for VRH
                vf2 = 0.20;     % used for VRH
                VF = [vf1 vf2]; % used for VRH
                cd1 = 0.055 ;
                cd2 = 0.055 ;
                ar  = 0.0001;   % 0.0001 is default aspect ratio (M. Savage)
                rhm = 2700;     % deep rock density
                vpm = 5.5;      % in TVZ wide range from 1.5 to 5.5km/s
                vsm = vpm/1.75; % Rawlinsons  model of RK/TVZ)
                vsc = 0;        % fluid = 0km/s, but might vary with solid infill

% Define the rotation of the matrix/fracture planes:

    %a = 0;  % null axis of rotation
    %b1 = 0:10:20 % corresponds 'dip' of fracture plane (80 deg dip)
    %c1 = -45; % corresponds azimuth of fracture plane ('plane' NE-SW azi 045)
    %b2 = 0:10:20 % 90deg dip
    %c2 = -90; % not sure where dip direction is on this set (need to check)

    for c1 = -25 %-45:10:-35 ; % crack plane strike rotation
        for b1 = -30:10:30 ; % crack plane dip rotation F1
            for b2 = -30:10:30 ; % crack plane dip rotation F2
                for c2 = -90;  % crack plane strike F2
                   for a = 0; % null axis of rotation
                        % 2 geothermal models in a loop (rhc and vpc):
                       for rhc = 100.5:862.4:962.9 ;
                           for vpc = 0.5073:1.0569:1.5642 ;


% Define 2 geothermal models based on rhc and vpc:

%                   rhc1 = 962.9 ; % 100C, 10MPa
%                   rhc2 = 100.5; ; % 400C, 20Mpa Diff = 862.4
%                   vpc1 = 1.5642; % 100C, 10MPa
%                   vpc2 = 0.5073 ; % 400C, 20Mpa Diff = 1.0569

                for  rhc = rhc ;
                    if rhc < 900  ;
                        vpc = 0.5073 ;
                        model = 'Supercritical' ;
                    else
                        model = 'Conventional' ;
                        vpc = 1.5642 ;
                    end
                end
```

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        % Change strike1 to right hand rule (RHR) relative to dip
        % and define dip1 direction
        % to annotate F1 correctly:

                 for b1 = b1 ;
                  if b1 < 0 ;
                      strike1 = 90 - c1 - 180 ;
                      dip1 = 90 + b1 ;
                      dipdir1 = 'SE' ;
                  else
                      strike1 = 90 + c1 + 180 ;
                      dip1 = 90 - b1 ;
                      dipdir1 = 'NW' ;
                  end
                 end

        % Change strike2 to right hand rule (RHR) relative to dip
        % and define dip2 direction
        % to annotate F2 correctly:

                 for b2 = b2 ;
                  if b2 < 0 ;
                      strike2 = 90 - c2 - 180 ;
                      dip2 = 90 + b2 ;
                      dipdir2 = 'E' ;
                  else
                      strike2 = 90 + c2 + 180 ;
                      dip2 = 90 - b2 ;
                      dipdir2 = 'W' ;
                  end
                 end

         % Changing negative angles from matrix rotation into
         % positive strike1 angle F1, (F1 orientation is constant N-S):

                 for strike1 = strike1 ;
                     if strike1 < 0 ;
                         strike1 = -1 * strike1 ;
                     else
                         strike1 = strike1 ;
                     end
                 end

%      strike1 = 90+c1+180 ;
%      dip1 = 90-b1 ;
%      strike2 = 90+c2+180 ;
%      dip2 = 90-b2 ;

%----------------------------------------

% Define 2 elasticity matrices and rotations (for VRH if required):

 [Ceff1,rh1] = MS_effective_medium('hudson',vpm,vsm,rhm,vpc,vsc,rhc,ar,cd1);
 [ROTCeff1] = MS_rot3(Ceff1,a,b1,c1);

 [Ceff2,rh2] = MS_effective_medium('hudson',vpm,vsm,rhm,vpc,vsc,rhc,ar,cd2);
 [ROTCeff2] = MS_rot3(Ceff2,a,b2,c2) ;

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% Calculating and plotting VRH average for multiple fracture families
% Annotating according to the parameters and saving the figures based on the
parameters:

                [Cav,rhav] = MS_VRH(VF, ROTCeff1, rh1, ROTCeff2, rh2);

                MS_plot(Cav, rhav, 'reverse');

text = ['[strike/dip (F1&F2)] = ' num2str('['), num2str(strike1), num2str('/'),
num2str(dip1), num2str(dipdir1), num2str(';'), num2str(' '), num2str(strike2),
num2str('/'), num2str(dip2), num2str(dipdir2), num2str(']')];

subtitle(text, 'fontsize', 8, 'FontWeight', 'bold');

path = 'C:\Users\jylhansi\OneDrive - Victoria University of Wellington -
STAFF\Desktop\Siru MSc\MSc_Siru (H)\MSAT CODE WORK\2023 FINAL
Analysis\Ceff_analysis_data\Elastic_Anisotropy\VRH
models\Beachballs_cd_strike_dip_var_2MOD';

txt = [num2str(model), num2str(strike1), num2str(' '), num2str(dip1), (' '),
num2str(strike2), num2str(' '), num2str(dip2)];

name = [txt '.png'];

tx = model

annotation('textbox', [0.6450 0.090 0.1657 0.1325],'String',
tx,'FitBoxToText','on','BackgroundColor', "w", 'FontWeight', 'bold', 'FontSize',
10);

saveas(gcf, fullfile(path, name), 'png');
close all

                            end
                        end
                    end
                end
            end
        end
    end
%--------------------------------------------------------------------------

    % END OF SCRIPT!
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%--------------------------------------------------------------------------
```