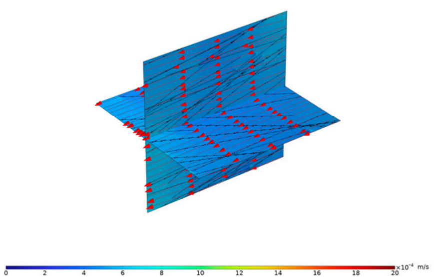
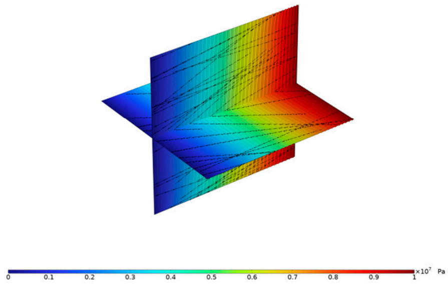
supplementary materials

Matrix permeability: $10^{-12}m^2$

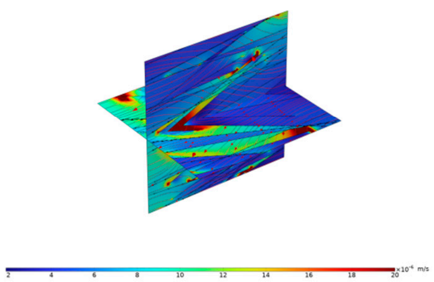


Darcy's velocity

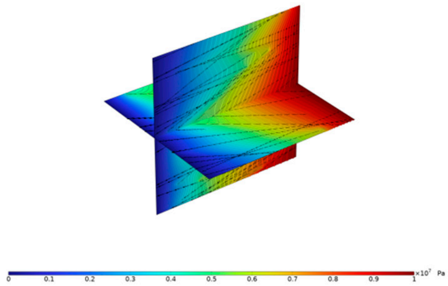


pore water pressure

Matrix permeability: $10^{-14}m^2$

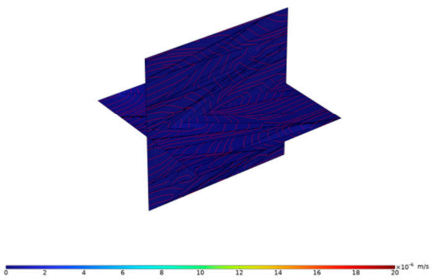


Darcy's velocity

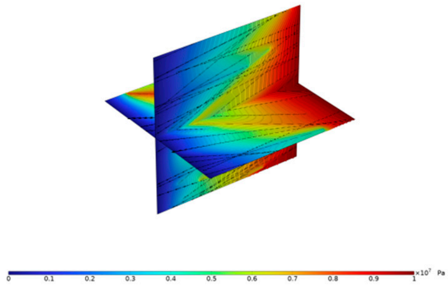


pore water pressure

Matrix permeability: $10^{-16}m^2$

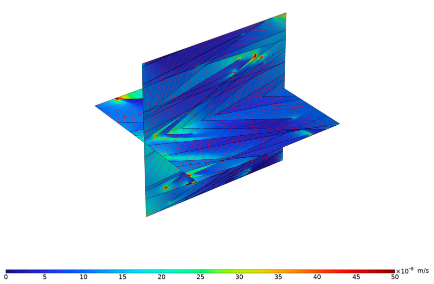


Darcy's velocity

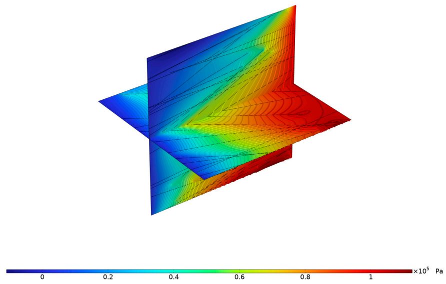


pore water pressure

Figure.S1 Darcy velocity and pore pressure cross-section diagrams at different matrix permeabilities hydraulic pressure:10^5Pa

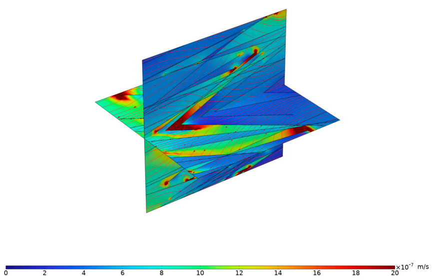


Darcy’s velocity

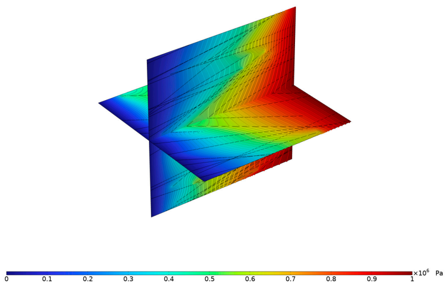


pore water pressure

hydraulic pressure:10^7Pa

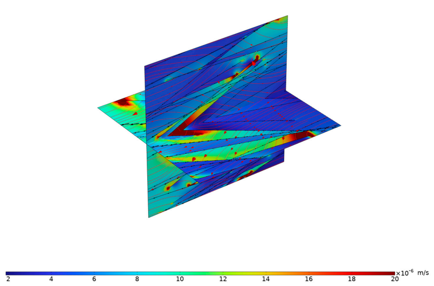


Darcy’s velocity

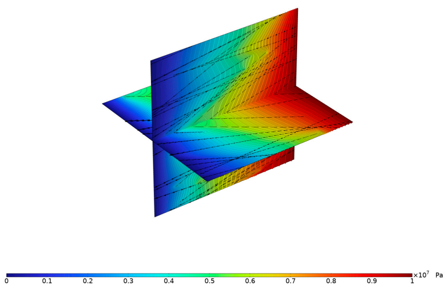


pore water pressure

hydraulic pressure:10^9Pa



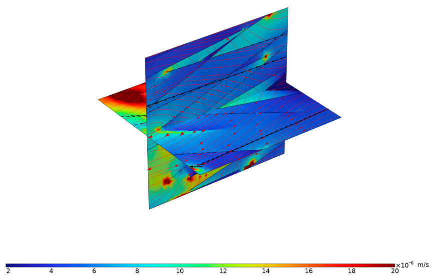
Darcy’s velocity



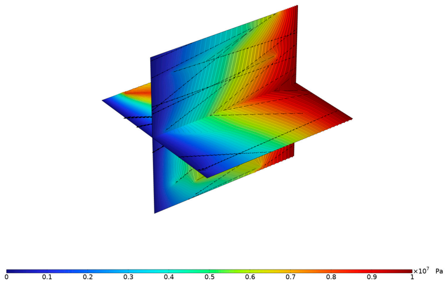
pore water pressure

Figure.S2 Darcy velocity and pore pressure cross-section diagrams under different water pressure conditions

Fracture density :0.0025/m³

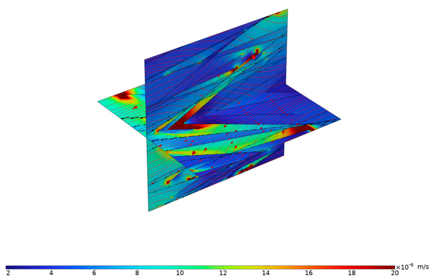


Darcy's velocity

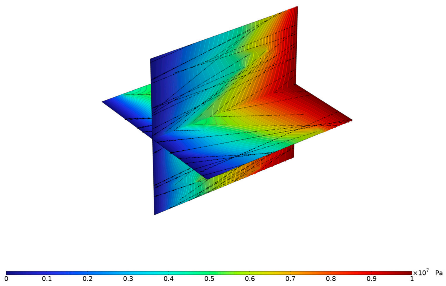


pore water pressure

Fracture density :0.0050/m³

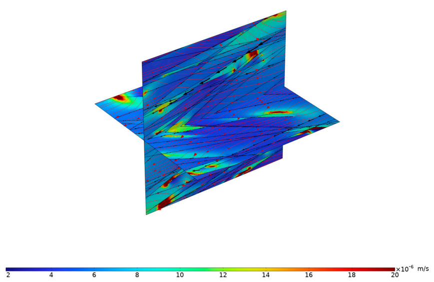


Darcy's velocity

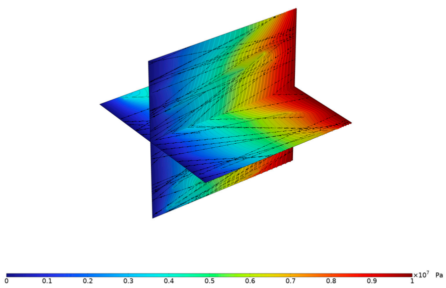


pore water pressure

Fracture density :0.0075/m³



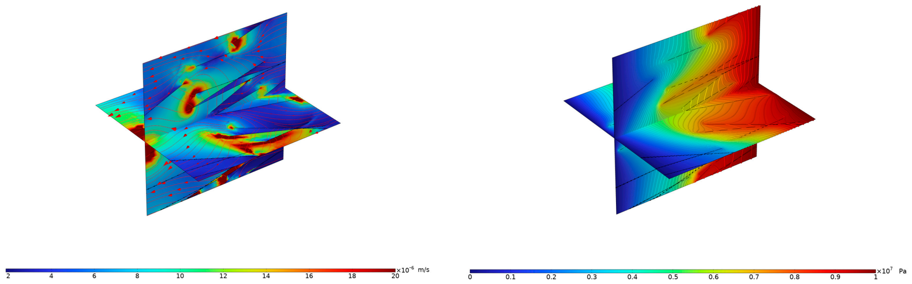
Darcy's velocity



pore water pressure

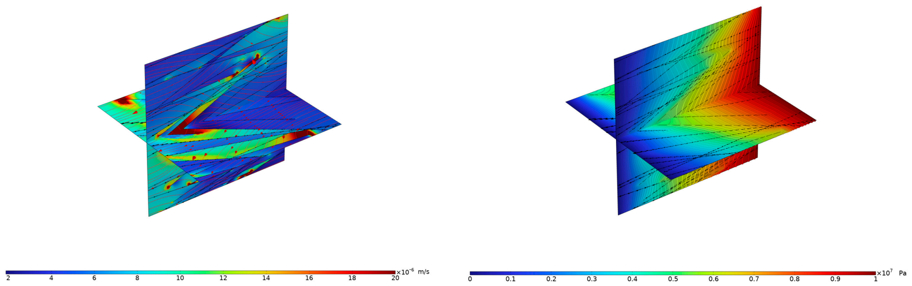
Figure.S3 Darcy velocity cross-section and pore water pressure cross-section under different fracture densities

Length of Fracture:5.5-10m



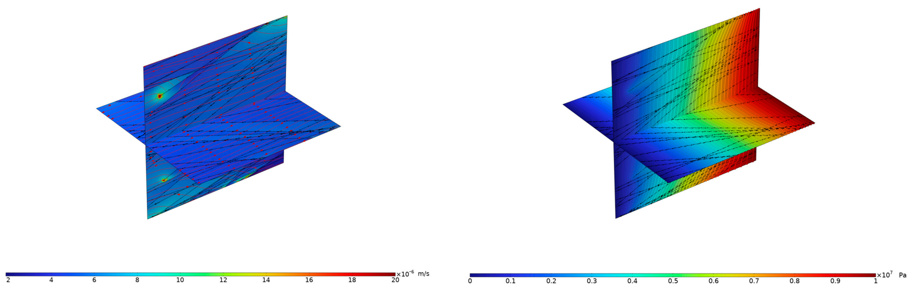
Darcy’s velocity pore water pressure

Length of Fracture:11-20m



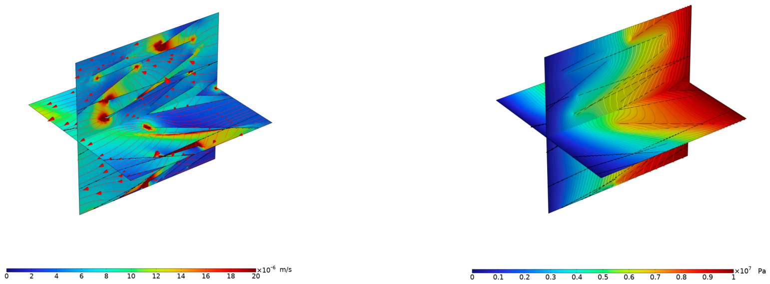
Darcy’s velocity pore water pressure

Length of Fracture:16.5-30m



Darcy’s velocity pore water pressure

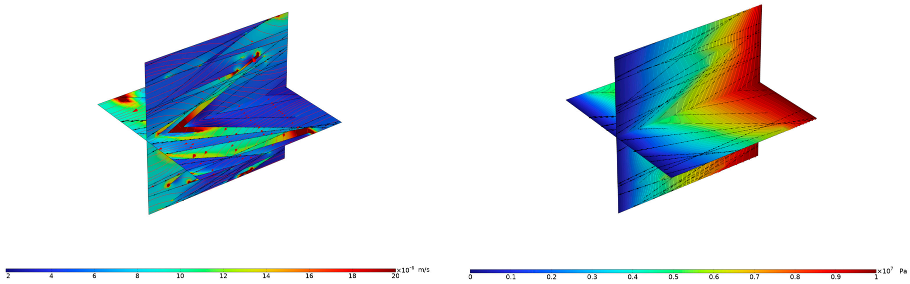
Figure.S4 Darcy velocity cross-section and pore water pressure cross-section under different fracture lengths fracture length ratio:0.25



Darcy’s velocity

pore water pressure

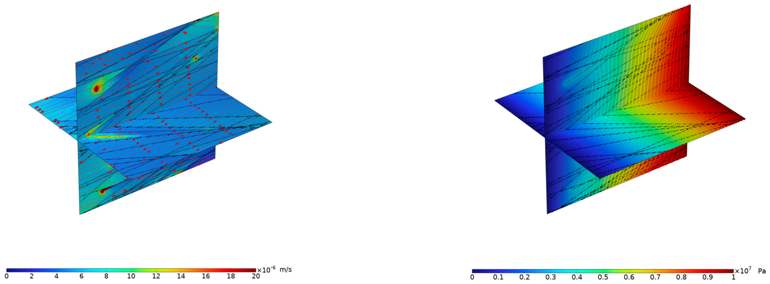
fracture length ratio:0.55



Darcy’s velocity

pore water pressure

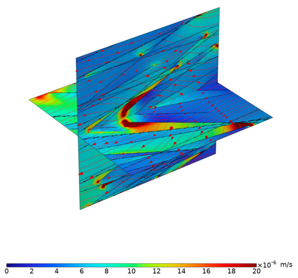
fracture length ratio:0.85



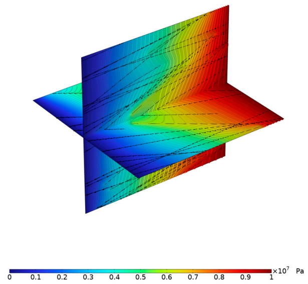
Darcy’s velocity

pore water pressure

Figure.S5 Darcy velocity cross-section and pore water pressure cross-section under different fracture length ratios fracture length power law:2

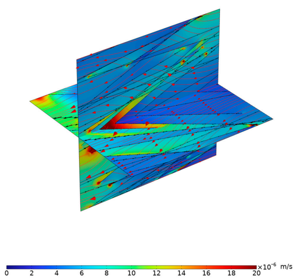


Darcy’s velocity

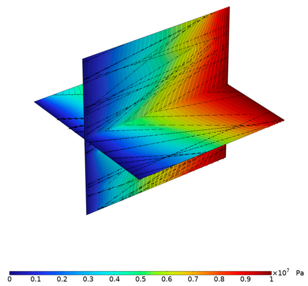


pore water pressure

fracture length power law:5

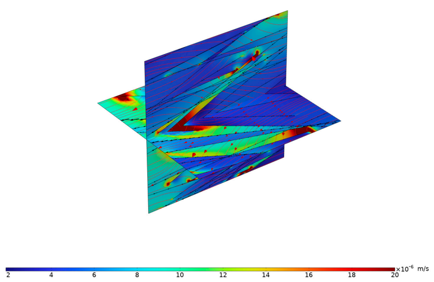


Darcy’s velocity

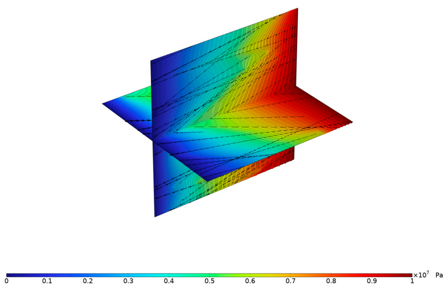


pore water pressure

fracture length power law:8

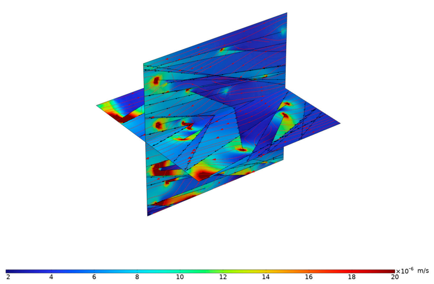


Darcy’s velocity

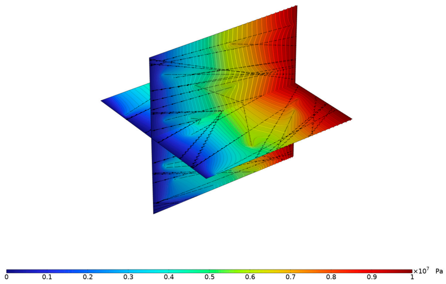


pore water pressure

Figure.S6 Darcy velocity cross-section and pore water pressure cross-section under different fracture length power law fracture Strike：0°　fracture Dip：45°

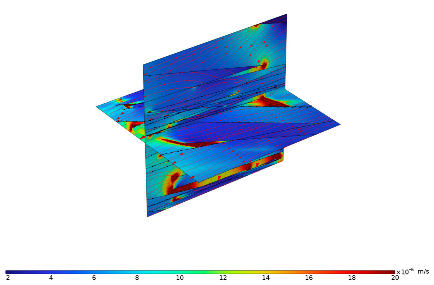


Darcy’s velocity

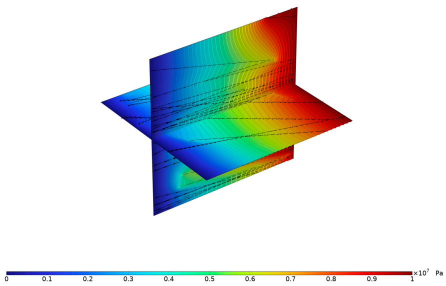


pore water pressure

fracture Strike：45°　fracture Dip：0°

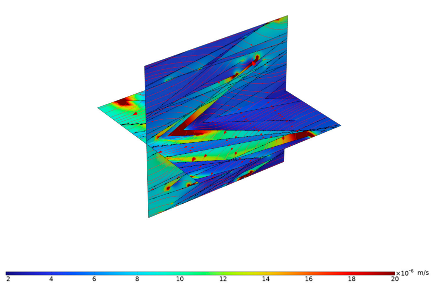


Darcy’s velocity

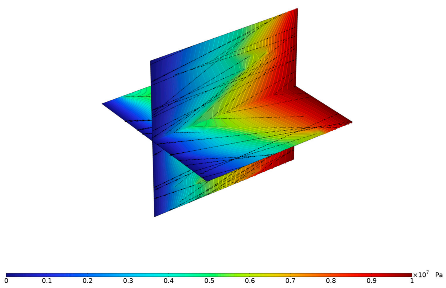


pore water pressure

fracture Strike：45°　fracture Dip：45°

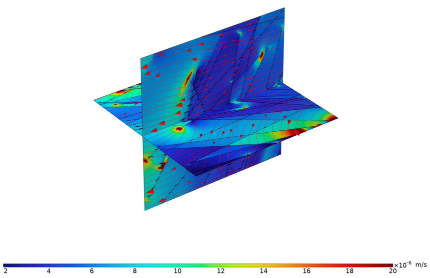


Darcy’s velocity

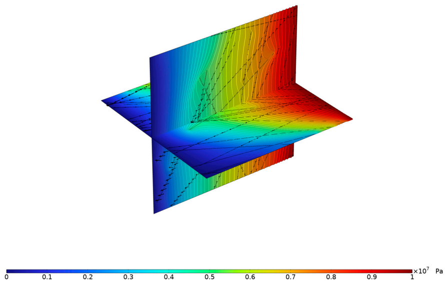


pore water pressure

fracture Strike：45° fracture Dip：90°

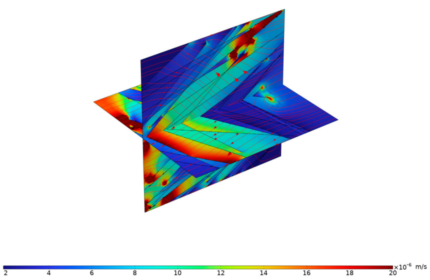


Darcy's velocity

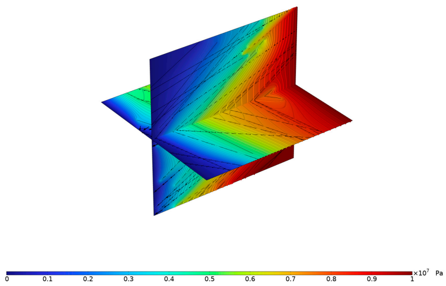


pore water pressure

fracture Strike：90° fracture Dip：45°

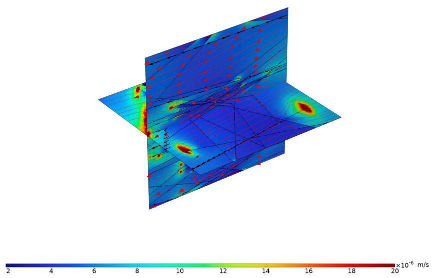


Darcy's velocity

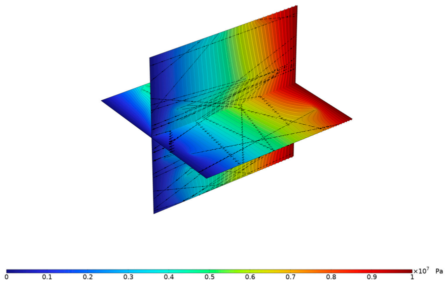


pore water pressure

Figure.S7 Darcy velocity cross-section and pore water pressure cross-section under different strike and dip of fracture angles dispersion coefficient：0.1

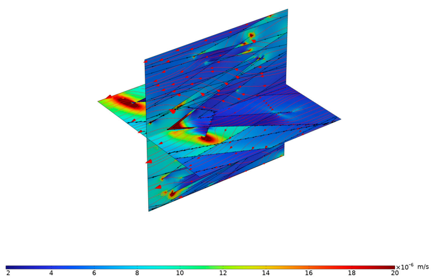


Darcy’s velocity

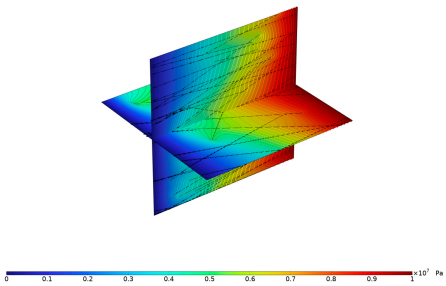


pore water pressure

dispersion coefficient：4.075

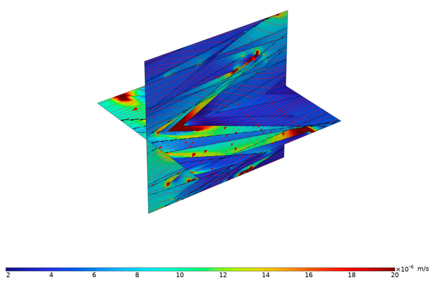


Darcy’s velocity

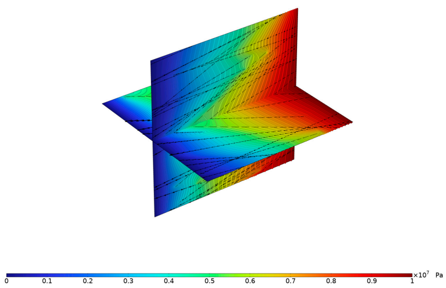


pore water pressure

dispersion coefficient：8.05



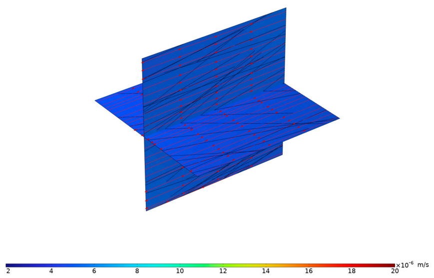
Darcy’s velocity



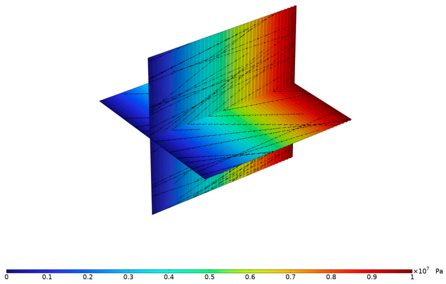
pore water pressure

Figure.S8 Darcy velocity cross-section and pore water pressure cross-section under different fracture dispersion coefficients

Fracture Aperture：0.01-0.06mm

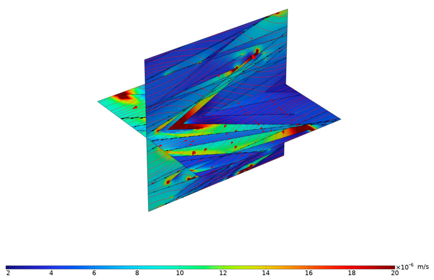


Darcy’s velocity

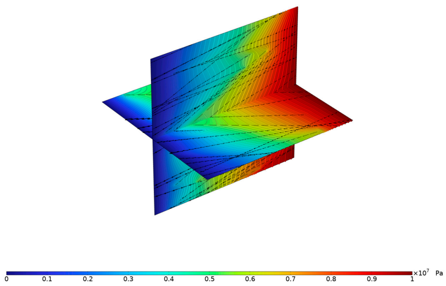


pore water pressure

Fracture Aperture：0.1-0.6mm

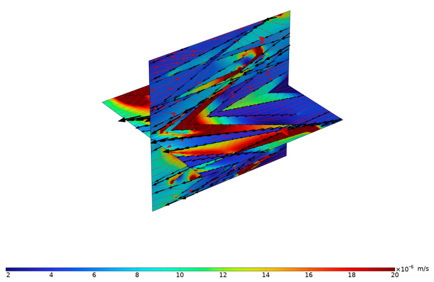


Darcy’s velocity

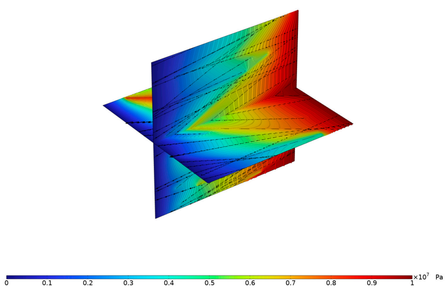


pore water pressure

Fracture Aperture：1-6mm



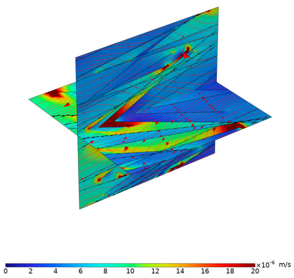
Darcy’s velocity



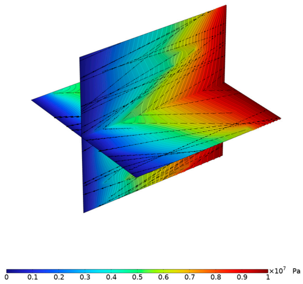
pore water pressure

Figure.S9 Darcy velocity cross-section and pore water pressure cross-section under different fracture Aperture

Aperture ratio：3

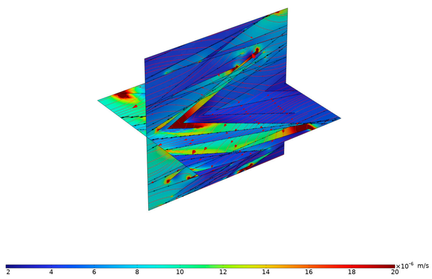


Darcy’s velocity

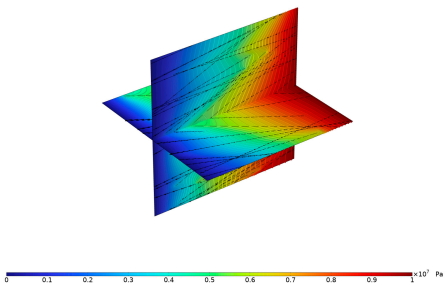


pore water pressure

Aperture ratio：6

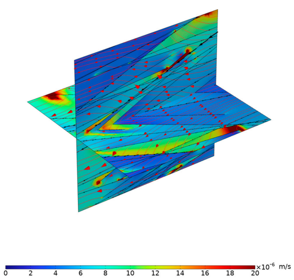


Darcy’s velocity

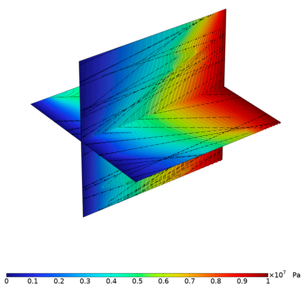


pore water pressure

Aperture ratio：9



Darcy’s velocity



pore water pressure

Figure.S10 Darcy velocity cross-sectional map and pore water pressure cross-sectional map under different aperture ratio

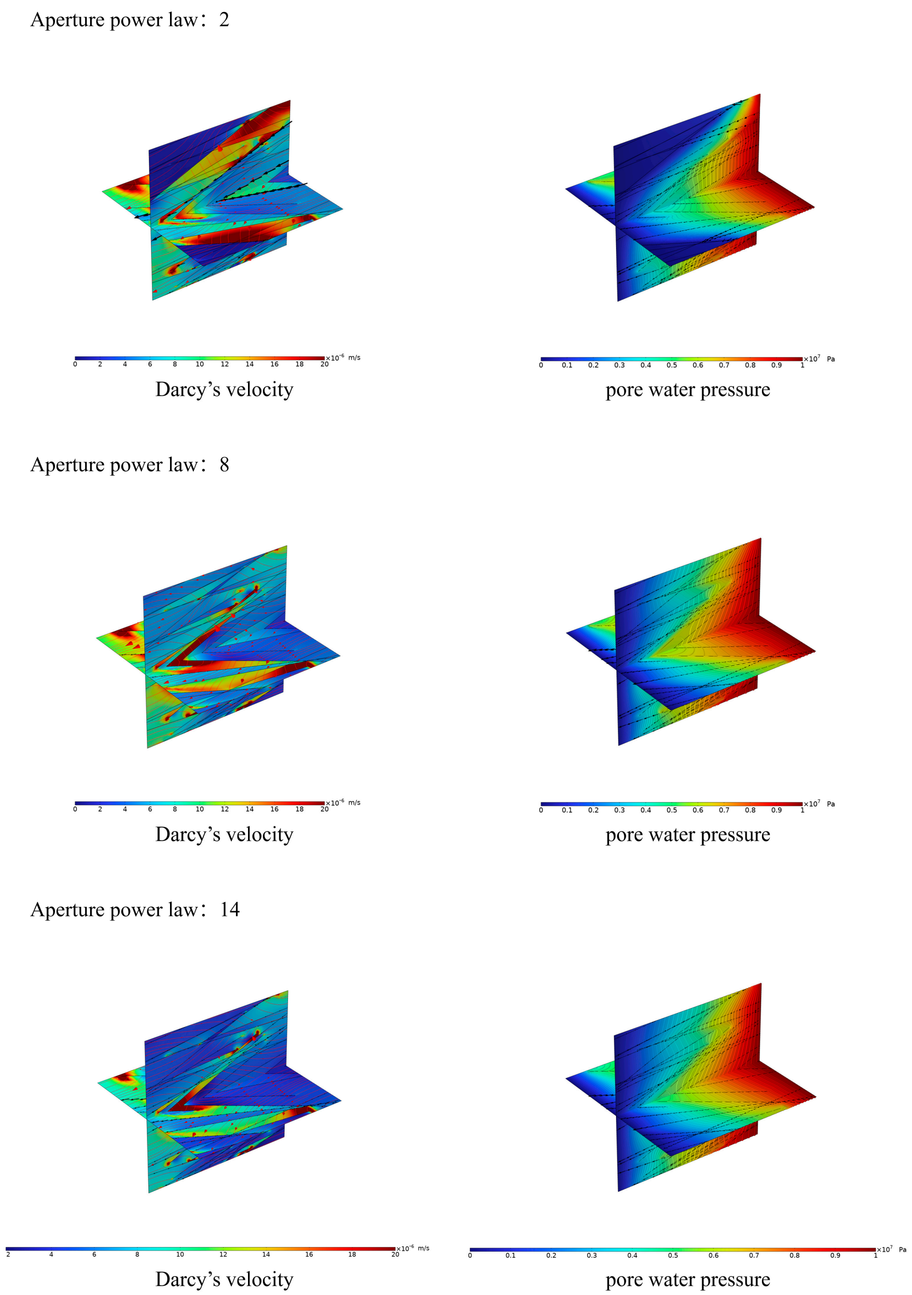


Figure.S11 Darcy velocity cross-sectional map and pore water pressure cross-sectional map under different fracture aperture power law

Table.S1 ANOVA for Quadratic model

Response 1: K

Transform: Base 10 Log

Constant: 0

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	11.96	44	0.2718	54.56	< 0.0001	significant
A-fracture length	1.93	1	1.93	387.50	< 0.0001	
B-fracture length ratio	4.31	1	4.31	864.59	< 0.0001	
C-fracture length power law	0.0812	1	0.0812	16.29	0.0002	
D- Strike	0.0296	1	0.0296	5.94	0.0190	
E-Dip	0.6894	1	0.6894	138.36	< 0.0001	
F-dispersion coefficient	0.0798	1	0.0798	16.01	0.0002	
G-Aperture ratio	0.0045	1	0.0045	0.9131	0.3445	
H-Aperture power law	0.5276	1	0.5276	105.90	< 0.0001	
AB	0.1097	1	0.1097	22.02	< 0.0001	
AC	0.0057	1	0.0057	1.14	0.2908	
AD	0.0166	1	0.0166	3.34	0.0744	
AE	0.0017	1	0.0017	0.3395	0.5631	
AF	0.0049	1	0.0049	0.9755	0.3287	
AG	0.0086	1	0.0086	1.73	0.1955	
AH	0.0196	1	0.0196	3.93	0.0537	
BC	0.1135	1	0.1135	22.79	< 0.0001	
BD	0.0189	1	0.0189	3.79	0.0579	
BE	0.0038	1	0.0038	0.7622	0.3874	
BF	0.0166	1	0.0166	3.33	0.0749	
BG	0.0120	1	0.0120	2.40	0.1286	
BH	6.789E-07	1	6.789E-07	0.0001	0.9907	
CD	0.0001	1	0.0001	0.0163	0.8991	
CE	0.0308	1	0.0308	6.18	0.0168	
CF	0.0055	1	0.0055	1.09	0.3011	
CG	0.0000	1	0.0000	0.0040	0.9502	
CH	0.0240	1	0.0240	4.81	0.0337	
DE	0.0419	1	0.0419	8.41	0.0058	
DF	0.0044	1	0.0044	0.8869	0.3514	
DG	0.0000	1	0.0000	0.0071	0.9334	

DH	0.0173	1	0.0173	3.47	0.0690
EF	0.0115	1	0.0115	2.31	0.1355
EG	0.0002	1	0.0002	0.0353	0.8519
EH	0.0066	1	0.0066	1.32	0.2561
FG	0.0029	1	0.0029	0.5898	0.4466
FH	0.0000	1	0.0000	0.0037	0.9517
GH	0.0047	1	0.0047	0.9410	0.3373
A^2	1.55	1	1.55	311.72	< 0.0001
B^2	0.7761	1	0.7761	155.77	< 0.0001
C^2	0.0050	1	0.0050	1.01	0.3196
D^2	0.0903	1	0.0903	18.12	0.0001
E^2	0.0383	1	0.0383	7.68	0.0082
F^2	0.0546	1	0.0546	10.95	0.0019
G^2	0.0081	1	0.0081	1.62	0.2104
H^2	0.0265	1	0.0265	5.33	0.0258
Residual	0.2192	44	0.0050		
Lack of Fit	0.2192	35	0.0063		
Pure Error	0.0000	9	0.0000		
Cor Total	12.18	88			

Factor coding is **Coded**.
Sum of squares is **Type III - Partial**

The **Model F-value** of 54.56 implies the model is significant. There is only a 0.01% chance that an F-value this large could occur due to noise.

P-values less than 0.0500 indicate model terms are significant. In this case A, B, C, D, E, F, H, AB, BC, CE, CH, DE, A^2, B^2, D^2, E^2, F^2, H^2 are significant model terms. Values greater than 0.1000 indicate the model terms are not significant. If there are many insignificant model terms (not counting those required to support hierarchy), model reduction may improve your model.

Table.S2 Fit Statistics

Std. Dev.	0.0706	**R^2**	0.9820
Mean	-12.06	**Adjusted R^2**	0.9640
C.V. %	0.5855	**Predicted R^2**	0.9084
		Adeq Precision	43.0790

The **Predicted R^2** of 0.9084 is in reasonable agreement with the **Adjusted R^2** of 0.9640; i.e. the difference is less than 0.2.

Adeq Precision measures the signal to noise ratio. A ratio greater than 4 is desirable. Your ratio of 43.079 indicates an adequate signal. This model can be used to navigate the design space.