

PNTE Program

Referred manuscript title: "A program for estimating the tortuosity of rocks from cast thin-section images". The program is composed of a main function file "PNTE.m" and 11 subroutines. The subroutines' corresponding inputs and outputs are introduced in front of each subroutine (see also Table 1 to 3). In this file, we provide a brief guide to using the program.

Step 1. Input tortuosity definition flags.

Parameter	Value
dtype	=1 width of the image, =2 straight-line distance between the inlet and the outlet.
ttype	=1 average tortuosity among all pi, =2 minimum tortuosity among all pi.

Step 2. Input pore space segmentation parameters (HSV color model).

Parameter	Value
Hmin	minimum of hue.
Hmax	maximum of hue.
Smin	minimum of saturation.
Vmin	minimum of value.

Step 3. Input dilation factor Df.

Parameter	Value
dilaf	dilation factor Df.
details	= 1 show the figures referred to detailed procedures, = 0 turn off the figures showing the detailed procedures.

Outputs: taun- the tortuosity of the pore network.

Table 1. Functions of the subroutines

Subroutines	Purpose
PoreSegmentation	The function segments the pore space from a cast thin section image.
pathrevision	The function is designed to generate and revise the pore network from the pore space.
IOIB	The function figures out inlets, outlets, and intersectional points & blocks of the pore network.
DWG	The function segments the pore space from a cast thin section image.
neiberdis1	The function provides the paths, lengths, and ends of all the path forks referred to the vertex di.
neiberdis2	The function provides the paths, lengths, and ends of all the path forks referred to the vertex di.
FWalgorithm	The function is Floyd-Warshall algorithm for solving all pairs shortest path problems.
tau	The function segments the pore space from a cast thin section image.
SPtrace	The function traces the shortest paths.
tracepath	The function figures out the trace and path between two vertices.

Table 2. Inputs of the subroutines.

Subroutines	Iutput	Description
PoreSegmentation	Image	RGB image of a cast thin section
	Hmin	minimum of hue
	Hmax	maximum of hue
	Smin	minimum of saturation
	Vmin	minimum of value
pathrevision	pp	the number of the rows of the cast thin section image
	qq	the number of the coloumns of the cast thin section image
	dilaf	dilation factor
	poresl	the pore space
	sp1	the pore network
	details	flag parameter defined in the main function
IOIB	pp	the row number of the cast thin section image
	qq	the column number of the cast thin section image
	sp1	the pore network
DWG	bw	the final pore network
	pois	the collections (vertices) of inlets, outlets, and intersectional points & blocks of the pore network
neiberdis1	di	the vertex di
	bw	the final pore network
	pois	the collections (vertices) of inlets, outlets, and intersectional points & blocks of the pore network
	blocks	the intersectional blocks of the pore network
neiberdis2	di	the vertex di
	bw	the final pore network
	pois	the collections (vertices) of inlets, outlets, and intersectional points & blocks of the pore network
	blocks	the intersectional blocks of the pore network
drpath	path	the fork paths of the vertex di
	lpath	the lengths of the fork paths of the vertex di
	bns	the vertex number of the fork ends referred to all the vertices in the pore network
Fwalgorithm	dis	the distance-weighted graph
	tnote	the matrix of the intermediate vertices used in the Floyd-Warshall algorithm
	pois	the collections (vertices) of inlets, outlets, and intersectional points & blocks of the pore network

Continued Table 2. Inputs of the subroutines.

Subroutines	Input	Description
tau	sp	the inlets of the pore network
	ep	the outlets of the pore network
	dis	the distance-weighted graph after applying the Floyd-Warshall algorithm
	dtype	=1 width of the image, =2 straight-line distance between the inlet and the outlet
	ttype	=1 average tortuosity among all pi, =2 minimum tortuosity among all pi
	qq	the column numbers of the cast thin section image
SPtrace	mm	the total number of rows of the final pore network image
	sp	the inlets of the pore network
	pi	the outlets referred to each pi
	bw	the final pore network image
	tnote	the matrix of the intermediate vertices used in the Floyd-Warshall algorithm
	tpath	the fork paths of each vertex in the pore network
	tbns	the vertex number of the fork ends referred to all the vertices in the pore network
	nt	the indices of the minimum tortuosity among all pi
tracepath	startp	start pixel
	endp	end pixel
	tnote	the matrix of the intermediate vertices used in the Floyd-Warshall algorithm
	tpath	the fork paths of each vertex in the pore network
	tbns	the vertex number of the fork ends referred to all the vertices in the pore network
	mm	the total number of rows of the final pore network image

Table 3. Outputs of the subroutines.

Subroutines	Output	Description
PoreSegmentation	pores1	the acquired pore space
pathrevision	osp1	the new pore network
IOIB	bw	the final pore network image
	pois	the collections of inlets, outlets, and intersectional points & blocks of the pore network
	sp	the inlets of the pore network
	ep	the outlets of the pore network
	mp	the intersectional points of the pore network
	bp	the intersectional blocks of the pore network
DWG	dis	the distance-weighted graph
	tnote	the matrix of the intermediate vertices used in the Floyd-Warshall algorithm
	tpath	the fork paths of each vertex in the pore network
	tbns	the vertex number of the fork ends referred to all the vertices in the pore network
neiberdis1	outlpath	the fork paths of the vertex di
	outlpath	the lengths of the fork paths of the vertex di
	branchends	the vertex number of the fork ends referred to all the vertices in the pore network
neiberdis2	outlpath	the fork paths of the vertex di
	outlpath	the lengths of the fork paths of the vertex di
	branchends	the vertex number of the fork ends referred to all the vertices in the pore network
drpath	opath	the output fork paths of the vertex di
	olpath	the output lengths of the fork paths of the vertex di
	obns	the output vertex number of the fork ends referred to all the vertices in the pore network
Fwalgorithm	dis	the distance-weighted graph after applying the Floyd-Warshall algorithm
	tnote	the matrix of the intermediate vertices after applying the Floyd-Warshall algorithm
tau	taupi	tortuosity of the shortest path pi
	taun	tortuosity of the pore network
	pi	the outlets referred to each pi
	nt	the indices of the minimum tortuosity among all pi
SPtrace	nettrace	the indices of the paths of all pi
	netpath	the paths of all pi
tracepath	trace	the distance-weighted graph
	spath	the matrix of the intermediate vertices used in the Floyd-Warshall algorithm