The source codes of crosshole seismic tomography were independently developed on the platform of MATLAB (R2014a). The basic aim of these codes is to iteratively derive the P-wave velocity (V_p) of the limestone stratum from an appropriate inversion algorithm, which helps to discover abnormal velocities indicating karst caves or fractured zones. The idea and framework of this software as well as the results of synthetic and real cases can be referred to "Theory and application.pdf". For the codes per se, explanations of each module are listed in Table 1 and the mechanism of parameter pass and coupling between modules is shown in Figure 1.

Table 1 List of each module

Module	Function name	Main features
Para-inputs	inputsFile. m	Provide global parameters for computation, including cell dimension, node number, acquisition geometry, coordinates of sources and receivers, file path of observed traveltimes, etc.
Main execution	main. m	Global management: coupling between modules and controlling the outputs of results.
Initial field computation	initialField. m	Create initial velocity field using straight raytracing plus Wiggins and stochastic inverse methods.
Ray tracing	rayTracing. m	"Main function" of the raytracing module, returning "distance matrix", "ray paths" and "theoretical traveltimes".
	relateMatrix. m	Compute the relate matrix required by Dijkstra algorithm.
	dijkstra. m	Searching for the min-traveltime paths of first arrivals (core of SPM algorithm).
	euclid_dist. m	Calculate the inter-nodes distance.
Inversion	dampfind. m	Pick the optimal damping factor and pass to the module of "lsqrSOL".
	lsqrSOL. m	"Main function" of the inversion module, computing the modifications of velocities and returning numerical characteristics (e.g., residual norms and variances) of iterations.
Velocity correction	neg_vel_rev. m	Search for the negative velocities and revise thereafter.
	superhigh_vel_rev. m	Search for the super-high velocities and revise thereafter.
Grid coordinate generation	xyGen.m	Calculate the coordinates of the grids.

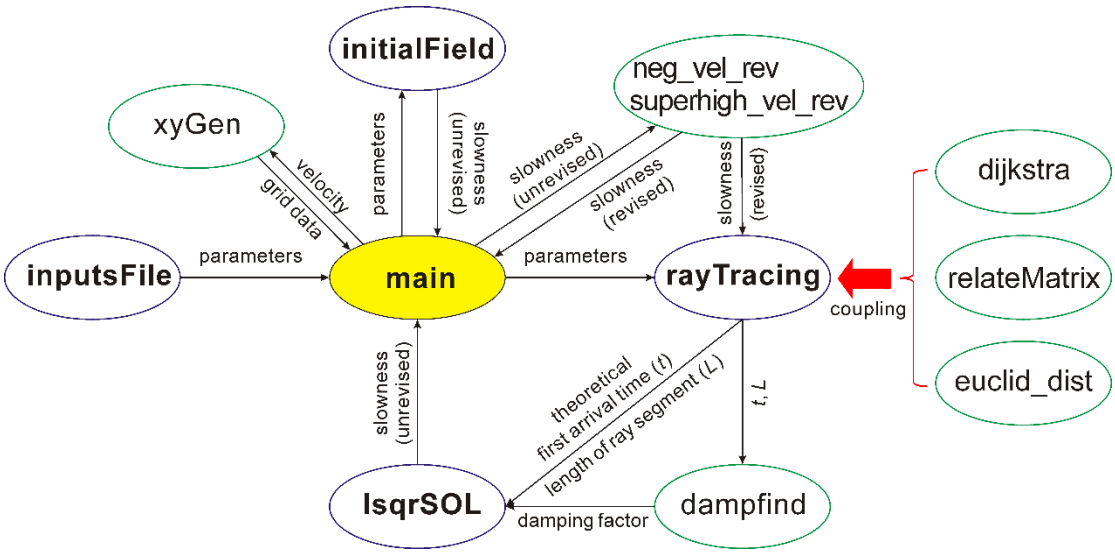

Figure 1 Mechanism of parameter pass and coupling between modules