Report about “Particle generator tool”

1 INTRODUCTION

Particle tester tool is a part of the *Particle system generator software*. The main objectives of the tool are: (i) Generation of the set of particles with parameters that have the same distribution as desired distributions; (ii) Searching for the shape for every particular generated particle with help of PSO algorithm; (iii) Preparing the output file suitable for the next tool – Particle system render tool.

2 PARTICLES GENERATOR TOOL INTERFACE

Main window of the particle generator tool with the description of its elements is shown in Figure 1. The interface was developed in python language with the use of PyQt 5.6 library. In the figure, the numbers indicate the following elements:

1. Block with input particle system properties. It has information about the number of generated pictures, amount of particles per each picture and the total number of generated particles. The parameter of axes number indicates how many radius vectors will be used in the shape search. If the checkbox “Only spherical particles” is checked then, during the particles generation, the special mechanism is used in which the particle is described not by a set of radius vectors, but by only one parameter – diameter. Thus, in the future, such particles are rendered as a circles with given diameters;
2. Block with name of the searching algorithm as well parameters for termination the search procedure as iteration and precision limit. Button with shown wrench on it opens the window with search algorithm settings;
3. Block with checkbox that enables the parallel generation of the particles with multithreading approach. Number of threads can be adjusted by pressing the button with shown wrench on it;
4. Block with basic information about the generation procedure. It contains the fields with information about started generation time, elapsed generation time so far, approximate time to finish the generation and the number of the already generated particles;
5. This block contains two buttons – “Generate” and “Stop” – designed for start and stop generation process correspondingly. There is also a green lamp indicating whether the generation is currently running;
6. Block with picture of the recently generated particle shape. It is possible to show or hide the particle with the checkbox “Show generated particle”;
7. Block with main shape parameters of the recently generated particle which shape is shown in the image above;

Indicator showing the percentage of completion of the particles generation process.

After clicking on the button in block 2 the window with searching algorithm parameters opens which is illustrated in Figure 2. These parameters – population size, inertia coefficient, damping ratio, personal acceleration, social acceleration, particle randomization and swarm randomization - are the hyperparameters of the algorithm affecting the search behavior. Buttons with blue arrow return the parameter values to the default values.

After clicking on the button in block 3 the window with adjusting the number of parallel searching threads opens as illustrated in Figure 3. The default number of searching threads is 4.

Main menu of the particles generator tool and the features it provides is described in Table 1.

Table 1. Description of the particles generator tool menu.

Menu item	***Icon***	***Shortcut***	***Description***
Distributions menu			
Open file…		Ctrl + O	Open the dialog window for choosing the xlsx file and then loading the parameters distribution data: CE diameter, circularity, convexity and elongation.
Show plots …		Ctrl + P	Show the separate window with plots showing the cumulative number based distributions.
Info menu			
Help		Ctrl + H	Open a .pdf file with help information about the tool.
About		Ctrl + A	Open window with some important information about the tool version and its developer.
About		Ctrl + A	Open window with some important information about the tool version and its developer.

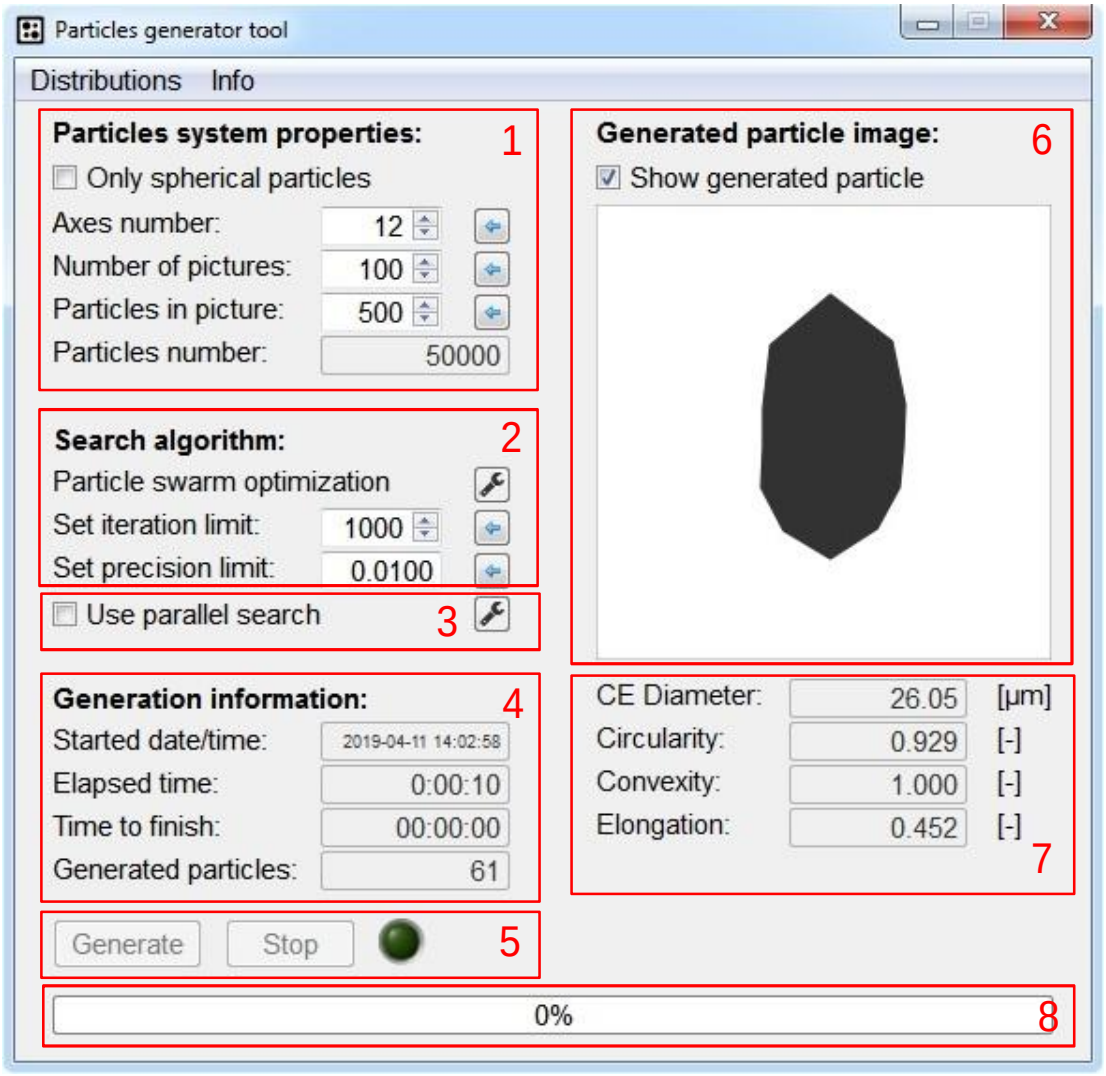

Figure 1. Main window of the particles generator tool.

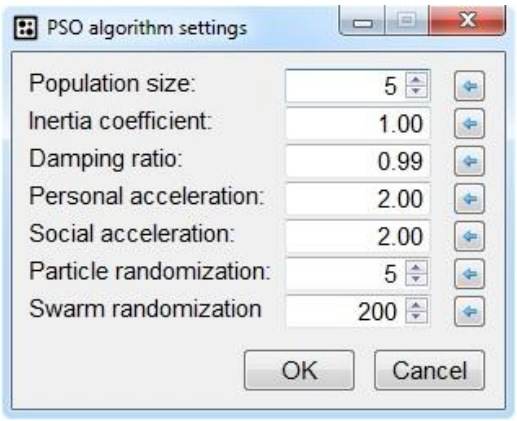

Figure 2. PSO algorithm settings.

Figure 3. PSO algorithm settings.