• Solar chimney power stations are particularly suitable for generating electricity in deserts and sun-rich wasteland.

• It provides electricity 24 hour per day.

• No any fuel is needed. It needs no cooling water and is suitable in extremely dryregions.

• It is particularly reliable and a little trouble-prone compared with other power plants.

• The solar chimney materials are: concrete, glass and steel. They can be easily foundanywhere in sufficient quantities.

• No ecological harm and no resources consumption.

Disadvantages

• Some estimates say that the cost of generating electricity from a solar chimney is 5 times more than from eg. a gas turbine.

• Solar chimneys have a very high capital cost.

• The structure itself is massive and requires a lot of engineering expertise and materials to construct [1].

Conclusion

Solar chimney power stations could make important contributions to the energy supplies in Africa, Asia and Australia, because there is plenty of space and sunlight available there. It is very important for the future, because our resources are limited, except our sun.

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STUDY OF PROBLEMS OF FOREST FIRE DANGER

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Introduction

Any natural phenomenon consists of a set of idealized processes. The study of such processes is the responsibility of various disciplines. Therefore, for a thorough in-depth study of natural phenomena thecertain disciplinesmust have an extensive knowledge base. When considering the phenomenon from the perspective of each discipline, contributes only part of the final result of the study. For example, it is necessary to use a set of disciplines, such as physics, chemistry, mathematics, and other,for the study of heat and chemical processes. During this process investigation by means of only one discipline, the result will be ineffective or not achieved at all.

This paper considers the mathematical model of forest fire danger. Knowledge gained in the study of several disciplines, namely mathematics, physics and chemistry, have been usedfor development and study of the models applicationresults. Research is conducted using a set of theories of different degrees of generality, developed in various disciplines.

Forest fuel layer with non-uniform inclusions of wood (thin branches of trees)is located on the surface. The material of inclusions differs from the forest fuel bythermophysical characteristics. The metal particle heated up to high temperatures drops out on aforest fuel layer. This variant of metal particles dropping corresponds to a scenario ofanthropogenous load on the forested territory[1].The forest fuel layer and inclusions are inertlyheated up. It is considered that conduction is the main heat transfer mechanism in this system [2]. It isaccepted that contact of particle and forest fuel layer is ideal [3]. The geometry of decision area is given in Figure 1.

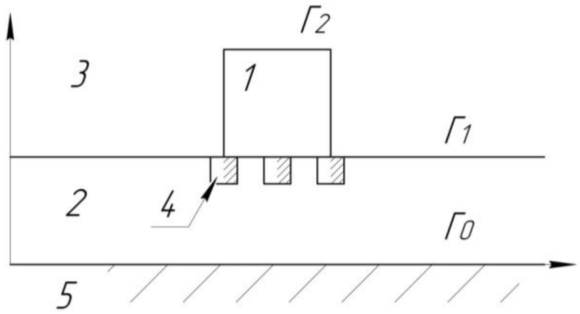

Fig. 1 The diagram of decision area: 1 – heated up to high temperatures particle; 2 – forest fuel layer; 3 - air; 4- inclusion in the form of wood; 5 - top soil layer.

Mathematical model

Heat transfer processes in the system “particle-forest fuel layer-inclusions” are describedmathematically by the non-stationary non-linear differential equations of heat conductivity with thecorresponding initial and boundary conditions. The energy equations are given below:

$$\rho_1 c_1 \frac{\partial T_1}{\partial t} = \lambda_1 \frac{\partial^2 T_1}{\partial x^2} + \lambda_1 \frac{\partial^2 T_1}{\partial z^2} \quad (1)$$

$$\rho_2 c_2 \frac{\partial T_2}{\partial t} = \lambda_2 \frac{\partial^2 T_2}{\partial x^2} + \lambda_2 \frac{\partial^2 T_2}{\partial z^2} + q_p k_0 \rho_2 \varphi \exp\left(-\frac{E}{RT_2}\right) \quad (2)$$

$$\rho_3 c_3 \frac{\partial T_3}{\partial t} = \lambda_3 \frac{\partial^2 T_3}{\partial x^2} + \lambda_3 \frac{\partial^2 T_3}{\partial z^2} + q_p k_0 \rho_3 \varphi \exp\left(-\frac{E}{RT_3}\right) \quad (3)$$

Boundary conditions on the boundary with the air environment:

$$\alpha(T - T_e) = \lambda_1 \frac{\partial T_1}{\partial z} \quad (4)$$

Boundary conditions on the "particle-forest fuel"boundary:

$$\lambda_1 \frac{\partial T_1}{\partial z} = \lambda_2 \frac{\partial T_2}{\partial z} T_1 = T_2 \quad (5)$$

Boundary conditions on the "particle-inclusion"boundary:

$$\lambda_1 \frac{\partial T_1}{\partial z} = \lambda_3 \frac{\partial T_3}{\partial z} T_1 = T_3 \quad (6)$$

Boundary conditions on the "forest fuel-inclusion"boundary:

$$\lambda_2 \frac{\partial T_2}{\partial z} = \lambda_3 \frac{\partial T_3}{\partial z} T_2 = T_3 \quad (7)$$

$$\lambda_2 \frac{\partial T_2}{\partial x} = \lambda_3 \frac{\partial T_3}{\partial x} T_2 = T_3 \quad (8)$$

Boundary conditions on the "forest fuel-soil"boundary:

$$T_2 = T_s \quad (9)$$

Boundary conditions on the decision areaboundary:

$$\lambda_1 \frac{\partial T}{\partial x} = 0 \quad (10)$$

$$\lambda_2 \frac{\partial T}{\partial x} = 0 \quad (11)$$

The kinetic equations of forest fuel and wood inclusions pyrolysis:

$$\rho_2 \frac{\partial \varphi}{\partial t} = -k_0 \rho_2 \varphi exp\left(-\frac{E}{RT_2}\right) \quad (12)$$

$$\rho_3 \frac{\partial \varphi}{\partial t} = -k_0 \rho_3 \varphi exp\left(-\frac{E}{RT_3}\right) \quad (13)$$

Initial conditions:

$$t = 0: \quad T_i = T_{i0}, \quad i = 1,2,3 \quad \varphi = \varphi_0 \quad (14)$$

Where T_i- temperature (1 – heated particle, 2 – forest fuel layer, 3 - inclusion in forest fuel layer); T_s- soil temperature;T_e- environmental temperature; ρ_i, c_i, λ_i - density, thermal capacity and heat conductivity (1 – heated particle, 2 – forest fuel layer, 3 – inclusion in a forest fuel layer);*t* – timex, z – spatial coordinates; q_p – thermal effect of pyrolysis; k_0 – pyrolysis pre-exponential factor; *E*– energy ofpyrolysis activation; *R* – universal gas constant.

Results

The finite difference method has been used for numerical implementation of the offered model. Thetwo-dimensional equations of heat conductivity have been solved by the locally-one-dimensionalmethod of Samarskiy A.A. Difference analogues of the one-dimensional equations have been solvedby marching method in combination with a method of simple iteration. The program component hasbeen developed for numerical modelling of heat transfer in the structurally non-uniform layer of forestfuel in a higher level language – Object Pascal.

The scenario of a fire-hazardous spring season in the territory of Timiryazevskiy forestry enterprise of Tomsk region has been selected for numerical modelling. For definiteness the environmentalparameters typical for May were used. The computing experiments have been made using mathematicalmodelling of heat transfer processes in a structurally non-uniform layer of forest fuel (pine needles)with inclusions from thin pine branches. In the considered scenario the structural heterogeneities havebeen located directly in contact boundary with a particle heated up to high temperatures.Monolithic structure of forest fuel layer was used for the modelling approach. Typical distribution oftemperature in the system “particle-forest fuel layer-inclusion” is given on Figure 2. Typicaltemperature dependence on time in forest fuel layer between two wooden inclusions is given onFigure 3.

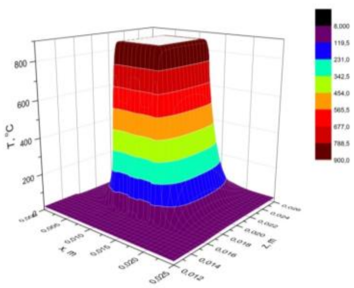

Fig. 2. Typical temperature distribution in system «forest fuel-inclusion-particle» in one second of heated particle impact

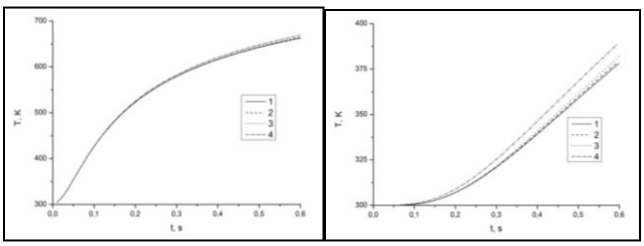

Fig. 3 Temperature dependence on time in forest fuel between the two inclusions: a) in upper layer of forest fuel; b) in a deeper layer of forest fuel. Distance to inclusion: 1 – 1.5 mm, 1 mm, 0.6 mm, 0.3 mm.

Conclusions

As a result of this work, a mathematical model of heat transfer in structurally inhomogeneous layer of forest fuel, exposed tohigh temperature steel particles, was developed. We obtained the temperature field in the "particle-layer forest fuel-inclusion" in different period preceding thelayercombustion.

When working with a mathematical model,it is necessary to use the knowledge from different disciplines, otherwise the true results will not be achieved.

Dependence analysis,given in Figure 3, shows the difference in heat transfer in a layer of forest fuel in the presence of inclusions in its structure. In a warm surface layer it is mainly due to the transfer of heat along the vertical coordinate from the heated particles. In deeper layers of the forest fuel the impactof a more heated charcoal inclusion also affects the heat transfer in the surrounding material.

As a result of computational experiments,it was found that presence of inclusions does not significantly affect the processes of heat transfer in a structurally inhomogeneous layer of forest fuel models for a monolithic structure of this layer. Thus, the developed mathematical apparatus can be used when creating new forest fire dangerforecasting. This mathematical apparatus can be used for both homogeneous and inhomogeneous layers of forest fuel.

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THE FEASIBILITY STUDY OF ELECTRONIC COMPONENTS APPLICATION IN MICRAN

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Micran is a modern innovative company working on basis full research - development cycle: research - development - production - sale - maintenance. Main work spheres are telecommunication and signal (connection), development microwave electronic components and products based on them, microwave instrumentation, radiolocation, test and measurement equipment and information security.

Nowadays, every company or institute should submit a feasibility study to develop and manufacture of unit (product, item), and Micran is no exception.