Friction is a common phenomenon in our everyday life that arises whenever solid bodies are in contact with relative motion. One of the fundamental properties of the frictional interaction is temperature at the contact interface. The temperature has essential impacts on almost all features of sliding contact, including mechanical, thermal, electric, tribological, chemical, structural, ecological, ergonomic characteristics, which is intimately related to important scientific problems such as quantification of airborne particulate matter emissions from sliding contacts, identification and modelling of friction surface destruction and wear mechanisms, prediction of dynamic characteristics of sliding and noise emissions, analysis of the formation and evolution of surface layers. The problem of determining temperatures at sliding contacts is one of the fundamental problems in Contact Mechanics, Tribology and Heat Conduction.

Different techniques were developed to measure sliding contact temperature. The most commonly used methods are the infrared radiation technique and thermocouple technique. The infrared radiation technique is based on that the radiative power depends on temperature. The infrared detector is focused on the contact area through a transparent component or at a surface close to the contact area. The technique is efficient, however, the requirement for at least one transparent friction component is not practical in most cases. The thermocouple technique is based on the direct conversion of temperature to electric voltage. The common approach is installing a miniature thermocouple in the stationary component as close as possible to the sliding surface. The thermocouples provide reliable measurements, but their service life is short due to the small distance between the junction and the wearable sliding surface. Thus, none of the two techniques allows continuous temperature measurements for wearable non-transparent surfaces. The purpose of the present project is to solve the problem of experimental determination of transient temperatures at sliding contacts. The solution of the problem will be achieved by developing a novel technique based on the application of a so-called *grindable thermocouple*, in which the measuring junction is created in the process of wearing of the sliding surface, and a *new signal processing procedure* to interpret correctly the signal from the thermocouple. The technique will enable measuring temperatures in microscopic layers of friction surfaces, which, in its turn, will allow to approach to solution of the important scientific problems mentioned above.

Successful implementation of the project requires solution of several nontrivial tasks using scientifically justified approaches and methods. At the first stage, experimental grindable thermocouples will be designed and manufactured. Unlike the existing grindable thermocouple designs, the cross-sectional shape of the thermocouple tip will be *circular*. The thermocouples will be manufactured by using the machining method and the deposition method. When using the machining method, small-diameter thermocouple wires are deformed into the thermoelectrodes with specified cross-sectional shapes. The thermoelectrodes are subsequently sandwiched with an electric insulation material, forming the thermocouple tip. The deposition method implies that the thermocouple tip is created by the serial deposition of microscopic layers of thermoelectrode materials and electric insulation. At the second stage, various mechanical, thermal, electric and tribological characteristics of the thermocouples will be determined experimentally. The thermocouples will be systematically tested on a pin-on-disc machine for various friction materials under different frictional and environmental conditions. The real surface temperature (reference temperature) will be measured using a high-resolution thermal camera. The signals from the thermocouples will be sampled with high frequency and converted to the digital form. At the third stage, based on the analysis of the measurement data, a temperature signal processing procedure will be developed to identify the fragments of the signal that correspond to the real surface temperature, which will include elimination of the noise and subsequent determination of the *lower envelope of the signal*. At the fourth stage, a feasible method of installing the thermocouple into the friction component will be developed.

The technique is expected to have noticeable scientific, environmental, technological and economic impacts. The scientific significance lies in that the proposed technique will be a noticeable step toward the solution of the fundamental problem of determination of temperatures at sliding contacts. Another important problem which arises in this project, is the interpretation of the temperature signal from the grindable thermocouple. This problem is intimately related to investigation of the Seebeck effect for a multiple microscopic junction subjected to mechanical and thermal influences, which is at the intersection of Electricity, Mechanics and Heat Conduction. The implementation of the technique may also have a positive influence on the development of theoretical methods of Heat Conduction and Thermoelasticity. A number of analytical and numerical models were developed to simulate temperatures at sliding contacts. The measurements done by the technique will allow to make comparisons between simulated and measured temperatures and to check qualitatively and quantitatively the validity of the models. The technological significance lies in that the technique will be applicable for almost all types of solid engineering materials and various friction conditions. The simple method of installation of the grindable thermocouple will allow its efficient utilisation.