

EP 3 460 727 A1 and EP 3 427 325 A1 disclose methods of the type in question for monitoring and fault identification in technical systems.

EP 3 142 909 A1 also teaches a method for ascertaining an operating stress of a part during the operation of the part. In an alignment phase, measured values relating to different operating modes of the part are used to ascertain a computation rule that can be applied in a subsequent operating phase to ascertain an operating stress.

The invention is based on the object of being able to perform the diagnosis of a technical system in an automated manner.

The object is achieved by the subjects of independent patent claims. Developments and configurations of the invention can be found in the features of the dependent patent claims.

A method according to the invention for diagnosing a technical system, in particular a rail-based vehicle, in particular a rail vehicle, wherein deviations of values, for example of recorded measured values, relating to at least n , with $n \geq 2$, different variables for describing a current state of the technical system, in particular of at least one component of the technical system, at a time from predefined values for describing a normal state are ascertained in order to infer a fault, comprises the following method steps:

- a. performing a main component analysis of predefined values relating to the at least n , with $n \geq 2$, variables and ascertaining at least one main component of the n variables;
- b. predefining the at least one main component for describing the normal state of the technical system;
- c. ascertaining the deviations of the values relating to the n variables for describing the current state of the

Method step a. takes place in particular during a learning phase. Method step b. also takes place in particular in the learning phase: at least one of the ascertained main components for describing the normal state of the technical system, in particular of the at least one component of the technical system, is predefined, in particular by means of the evaluation unit. Main components comprise as straight lines the values relating to the n variables for describing the normal state of the technical system in relation to which the deviation of the values relating to the n variables for describing the operating state are ascertained. Main components are normally represented in vector notation and are thus also referred to as a main component vector.

In method step b. no more than x , with $1 \leq x < n$, main components of the n variables for describing the normal state are predefined. In the case of two variables T_1 and T_2 , only one main component for describing the normal state of the technical system is therefore predefined. In a development, exclusively the main components that together cover at least 70% (cumulative percentage), in particular at least 80%, of the total variance of the values of the n variables for describing the normal state are predefined. A further development provides for only the dominant main component, that is to say the main component having the largest share of the total variance of the data, to be predefined.

The main component analysis is accompanied by a data reduction. Extensive datasets are simplified and structured, since a multiplicity of variables are approximated by a small number of main components that are as descriptive as possible. The performance of a main component analysis and the predefining of at least one main component for describing the normal state of the technical system can also be carried out in an automated manner.