Fault detection and diagnosis has received increasing attention since the last two decades. The detection of faults at an early stage, their isolation and the analysis of their causes are essential to ensure the safety, reliability and good performances of the application.

For example, electrical rotating machines usually operate by means of bearings which are among the most critical components [1], the quality of the motor system operation is closely related to the performance of bearing assembly. Among the state-of-the-art, vibration monitoring is asserted to be one of the most effective and practical techniques to detect and diagnose bearing faults [2], unfortunately, the vibration sensors may be exposed to failures in hard industrial conditions. Therefore, it is necessary to detect these failures, isolate the sensor and estimate the faults amplitudes in order to correct the measurements.

Just as any dynamic system, a sensor fails if a failure occurs in any of its components including the sensing device, transducer, signal processor, or data acquisition equipment. An abrupt failure in the sensor can be caused by a power failure or corroded contacts, while an incipient failure such as drift and precision degradation can be caused by deterioration in the sensing element. As defined in [3], both an abrupt and an incipient failure can cause non-permitted deviation from the characteristic property in a sensor, which leads to inaccurate measurements from the monitored system. Consequently, a faulty sensor can cause process performance degradation, process shut down, or even worse in a safety critical system. The detection of incipient sensor failures that is important for critical information to diagnose and control systems has received limited attention in literature [4],

A conventional engineering method for sensor validation is to check and recalibrate a sensor periodically according to a set of predetermined procedures. Although this method has been widely implemented in industry for detecting abrupt sensor failures, it is not able to accomplish continuous assessment of a sensor, and thus is not effective in detecting its incipient failure [5],

Different from model-based approaches that require accurate analytical multiphysics-based description of the target system, data-driven methods, also known as process history based methods, require the availability of sufficient data [6], Various methods have been developed to establish the knowledge database for the underlying system by extracting characteristic features directly from its past performance data.

The Network-on-Chiphas been recognized as a paradigm to solve System-on-Chip (SoC) design challenges. The routing algorithmis one of key researches of a NoC design. Its importance and effect on the performance of the network is accordingly cardinal. High performance, load-blance deadlock-free and livelock-free faulttolerant are the desirable properties of a routing algorithm for NoC. In 2007 Intel announced a prototype 80-core tera-scale processor using Networkon-Chip (NoC) technology. NoC is used as an alternative to the ubiquitous bus technology in order to facilitate communication among many cores. As the process technology shrinks and more cores are integrated on the same chip, the current bus approach for communication among cores will not be sufficient. A technology called NoC is proposed and generally viewed as the ultimate solution for the design of modular and scalable communication architectures and provide inherent support for the integration of heterogeneous cores through the standardization of the network boundary. The routing algorithm is one of key researches of a NoC design. Its importance and effect on the performance of the network is accordingly cardinal. Topology, switching mechanism and routing algorithm are three important items in the design of an NoC. The topology defines how the nodes (processing elements) are interconnected in the network. Numerous topologies including mesh, torus, fat trees and butterflies has been proposed in. Fixed tile size mesh topology is favored by many research groups because of its layout efficiency, good electrical propertiesand simplicity in addressing on chip resources. When a packet header reaches an intermediate node, the switching method determines how and when the switch is set; that is, the input channel is connected to the output channel. There are three well-known switching techniques: store-andforward, virtual cut-through and wormhole. Wormhole is a widely used switching method due to its low buffering requirements and more importantly, because it makes packet delivery time almost independent of the distance between source and destination nodes. In wormhole switching, a packet is divided into a sequence of fixed-size units, called flits. The header flit (containing routing information) establishes a path through the network while the remaining body flits follow it in a pipelined fashion.