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TECHNICAL CONTRADITIONS SOLVING TECHNIQUE IN PLANT MAINTENANCE

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ABSTRACT

The present paper deals with advanced techniques for solving technical problems in plant maintenance. It describes a methodology based on the modeling of technical contradictions and the use of inventive principles to overcome them. The article contains two practical examples illustrating the great potential of these techniques for recent plant maintenance.

Keywords: maintenance, technical contradiction, inventive principles, contradiction matrix.

INTRODUCTION

Engineering systems change qualitatively during the improvement activities and in the direction to the ideal solution. All technical changes are accompanied by conflicting requirements (contradictions, technical barriers, restrictions etc.) and the necessity of their removal. As a rule, contradictions first arise from the subsystem, then they are specified at the level of the changed system, and the contradictory requirements eventually become clearer at the level of subsystem elements. Technical contradiction is a contradiction that arises between several technical systems or components of one system. Improving one part of the system in a known (usual) manner inadvertently aggravates another part of the system and vice versa. In order to solve technical contradictions technique described in (Altshuller, 1988) is used. While this technique is frequently used in the field of product innovation, it is not enough used to solve technical problems associated with plant maintenance.

RESULTS AND CONCLUSIONS

The method of solving of technical contradictions related to plant maintenance issues is illustrated by an example of fluid leakage from a flange connection. Using the contradiction model (Figure 1) and the contradiction matrix (Rantanen, 2007), the following two inventive principles were recommended to solve this problem:

a) inventive principle #1: segmentation:

- divide an object into independent parts
- make an object sectional - easy to assemble or disassemble
- increase the degree of fragmentation or segmentation

b) inventive principle #11: cushion in-advance:

- prepare emergency means beforehand to compensate for the relatively low reliability of an object.

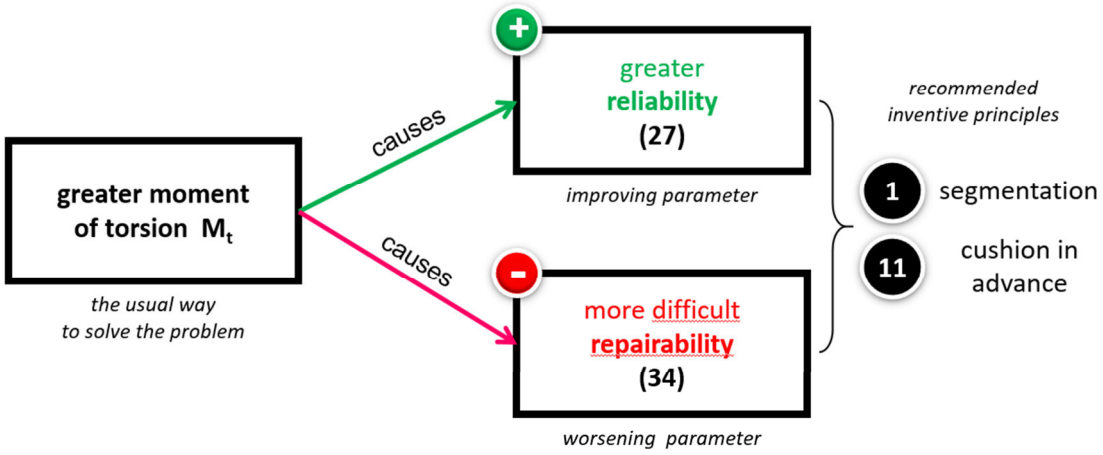

Fig. 1 - Model of technical contradiction for "medium leakage"

In accordance with Principle #1, it is recommended "to divide an object into an independent part or increase the fragmentation of an object". An example of the use of this inventive principle is, for example, an innovated type of gasket with graphite coated (or PTFE coated) round edged beveled metal ribs when compressed create separate sealing chambers that breakdown system pressure across the gasket face (Figure 2). This gasket (AIGI, 2013) is, as compared to traditional shapes, able to provide better sealing properties. The seals are formed in the form of a "bridge", even after compression, and in this case they also create a continuous sealing surface. Individual ribs of the seals tend to "open" under the pressure of the media to reduce its leakage.

Fig. 2 - Application of inventive principle #1 segmentation in a form of innovated gasket (AIGI, 2013)

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