Maintenance-related thoughts

ABSTRACT

We discuss the practical aspects of maintenance, challenge time-based approaches, and introduce data-driven alternatives. In addition, we question the notion "maintenance-free" and emphasize the critical role of maintenance in ensuring optimal asset performance.

KEYWORDS:

maintenance, deterioration, asset management, time-based maintenance, predictive maintenance, condition-based maintenance, monitoring, diagnostic

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# "Everything put together, sooner or later, falls apart"

Paul Simon, singer/songwriter

The quotation from Paul Simon may not seem to be particularly deep, but the basic idea that things deteriorate over time through a variety of failure modes is strongly related to maintenance.

But what is maintenance? If we look at the origins of the word, it comes from the Latin: "manu tenere," which means "to hold in the hands." Maintenance, then, is (or at least was) a practical intervention and requires physical interaction with an object. Maintenance may also be described as the "management of deterioration," as the performance of an object will deteriorate over time with use, through interaction with the environment, and through other causes such as vandalism or mishandling. In addition, anything with moving parts is likely to be more prone to deterioration than something which is purely static. We should note that the deterioration in performance may be accompanied by other ill effects: oil leaking from a damaged transformer radiator,
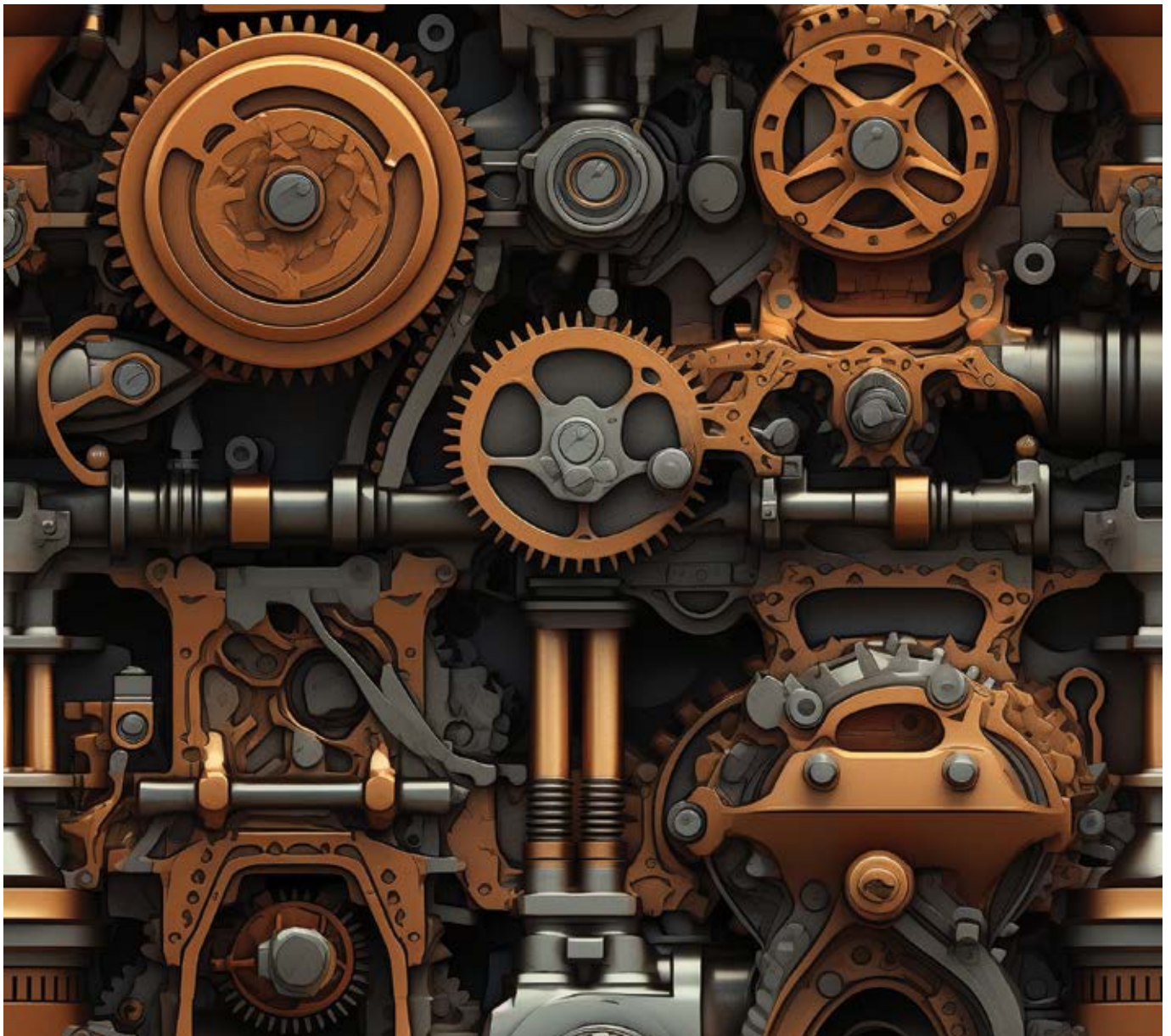
for example, or SF6 from a poor circuit breaker, which may have large environmental impacts.

But how do we know what deterioration is in progress, and how much time do we have before we need to address it?

What we need to do is to generate data that can be used to identify how much deterioration has taken place and how long we have before the performance reaches a point where the object becomes unfit for service. We can generate useful data through tests, inspection, monitoring, and so on. All such data generation is part of the maintenance management activity but may not be, in strict terms, "maintenance" itself: "maintenance-related activities" maybe?

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Time-based maintenance makes an assumption that performance will degrade over time in a manner that is predictable, and we can regularly intervene to address the deterioration. The problem is the deterioration is variable, and we may find that it has gone well past a point where we can economically address it, or the deterioration may be very "light," and maintenance is not worth doing. And, as has been noted in many places and summed up by Azevedo [1]:

"…reactive maintenance strategies (implementing the frequent dismantling and repair of machines), which are developed to maintain the machine's level of reliability, tend to have the opposite impact".

Maintenance is part of the asset management process and needs to be managed if our assets are to perform correctly for their expected life and beyond

There have been several attempts to address issues with unnecessary maintenance interventions through "predictive maintenance" or "preventive maintenance," and so on, and now "condition-based maintenance" and "risk-based maintenance": all such approaches require data which can be used to identify deterioration and failure mode progression, which then, hopefully, allow for maintenance to be performed in a timely manner.

So… what is "maintenance free"? It means we never have to physically touch the object as its performance will not deteriorate over time – we do not need to look for failure modes, we do not need to check and verify performance. Well, that may be the theory,

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but how do we know? We need to generate condition and performance data through inspection, or monitoring, or whatever to confirm the situation: inspection of oil level in a transformer, for example, or checking pumps and fans on the radiators, or inspecting air filters in a battery room, and so on.

So, if someone claims their device is "maintenance-free" you may wish to find out what inspection or test or monitoring or verification activities need to be carried out. Is it a claim of "fit and forget"? In this case, you may wish to confirm that there are no failure modes that will progress during the life of the device – especially for devices with pumps, motors, or fans that are out in harsh conditions in the real world. And, by the way, do we get a warranty covering the whole of life? If the device is maintenance-free, why wouldn't you?

Maintenance is part of the asset management process and needs to be managed if our assets are to perform correctly for their expected life and beyond. Maintenance, inspection, and evaluation of performance go together.

Bibliography

[1] C. de Azevedo, *"Asset Management Insights"*, Industrial Press, 2019

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