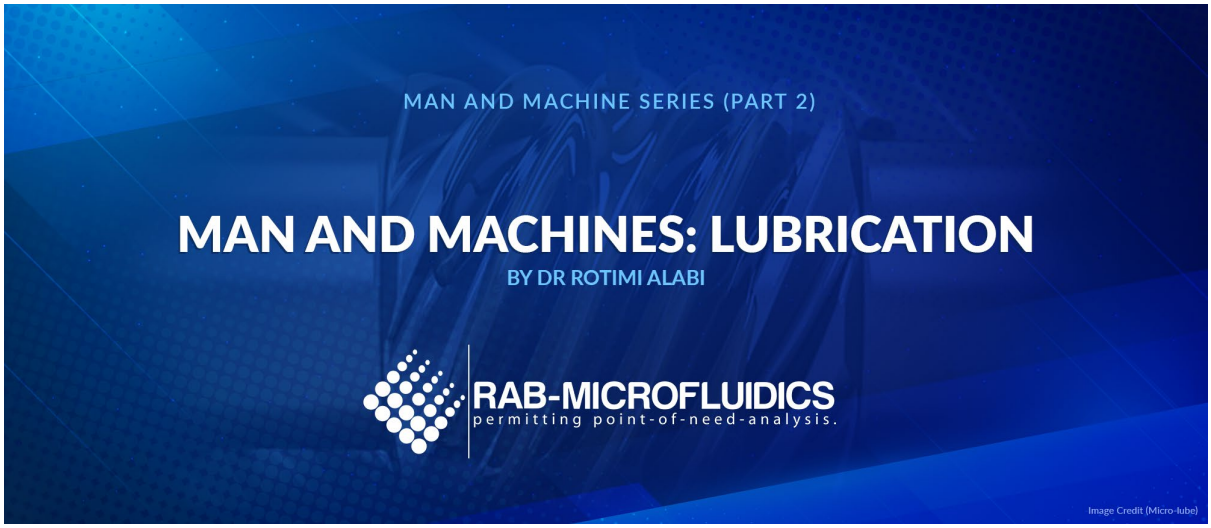

Like humans, machines are made up of many individual moving parts which move together in an extremely coordinated manner. A human joint for example is a typical moving part in humans where two or more bones meet to aid certain type of directional or rotational movement. Similarly, bearings and gears are examples of areas of metal to metal contact that permit directional or rotational, movements in a machine. During operation, these moving parts grind against each other. The friction created generates heat, leading to the wear and drop in efficiency overtime. To reduce this friction and resulting loss in efficiency, some form of lubrication is required. Synovial fluids and the protein, lubricin act as the body's lubricant, reducing friction in joints, dissipating heat, and acting as shock absorbers. In machines, specially formulated lubricating oils (lube oils) and greases are used. Machinery lubrication is important for several reasons; it reduces the friction and wear between moving parts. It also helps to dissipate the heat generated by the friction of metal grinding on metal. Machinery lubricants also act to absorb shock, minimise corrosion on metal surfaces, keep contaminants out, while sealing and protecting the component parts of the machine.

The engine lubrication system is very similar in principle to the circulatory system in man. We have a circulatory system that is designed to deliver blood laden with vital components like oxygen and nutrients to all areas of the human body. The lubrication system is also designed to distribute lube oil carefully engineered to contain additive components such as corrosion inhibitors, dispersants, detergents, anti-wear agents etc. to moving parts of the machinery. Lube oil held in a pan at the base of the engine called a 'sump' is pulled by an oil pump through a strainer that helps remove large contaminants from the volume of the lube oil. The oil pump forces the lube oil under pressure through the oil filter into the main bearings of the engine. Oil from the main bearings move into the crankshaft through drilled channels where it lubricates moving parts such as cylinder walls, piston-pin, bearings, gears, camshaft bearings, drive, timing chains etc. The oil then drains to the sump in a continuous circulating process that is similar to the circulatory system in the human body. In the human circulatory system, the heart functions as a pump to drive blood containing nutrients and oxygen through special channels called arteries to all parts of the body such as the limbs, brain, stomach etc. The kidney acts as the body's filter, cleansing the blood of toxins in a function that is similar to the oil filter in an engine.

Given the above, it is little wonder that the parallels between man and machine now extend into the science of lubrication. Increasingly, researchers and scientists are drawing parallels

between human and machinery lubrication. For instance, the new field of bio-tribology which is the science of biological surfaces in sliding contact that includes friction, wear and lubrication of interacting surfaces has been adapted mostly from the traditional field of tribology. Classical tribology which studies friction, wear and lubrication is an intersecting field of engineering and chemistry that focuses on interacting surfaces in relative motion. The essence of this field is to better understand the conditions of successful operations of machinery.

It is almost inevitable that machines will develop some form of mechanical failure over their operational life. So, it is important to diagnose any such failure early, especially for critical pieces of equipment such as can be found in power generating facilities, in the different modes of transport etc. The final part of this three-part series discusses the monitoring of machines and diagnosis of potential early failure in these critical machines.

By Rotimi Alabi