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Modeling the Collision Phenomena of Ø11X19 Size Rolls

This paper presents a numerical comparison using dynamic modeling techniques, of physical phenomena occurring at collisions between two rollers in a lot of distinct situations: impact on the edge at angles of 0°, 10°, 20°, 30°, 40°, 50°, 60°, 70°, 80° and impact on generator. These situations occur frequently in the manufacturing process of small cylindrical rollers.

Keywords*: bearing, cylindrical rollers, collision*

1. Introduction

During the manufacturing process of small cylindrical rollers that equip radial bearings some significant defects can occur. Radial bearings have rollers which fit tolerances of the order of hundreds and after processing are sorted into groups with restricted tolerance.

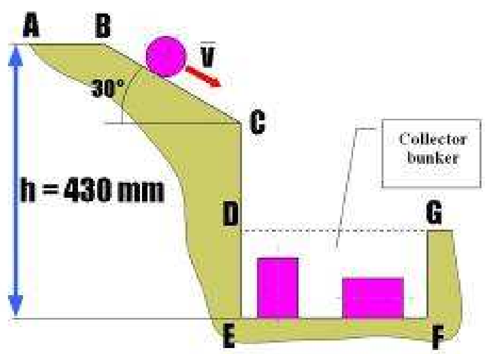


Figure 1. Rollers circuit to the collector bunker

Besides dimensional tolerance sorting, shape tolerances are required (straightness, circularity, conicity) in order to achieve the identical shape of rolling bodies with cinematically correct geometrical shape following the operation in the best possible conditions.

Roll surface roughness is also very important and should be done within certain limits.

Figure 1 presents the circuit of a roller bearing until it reaches the collector bunker where it falls from a certain height, with a determined speed and under different angles. It is of importance the angle of impact between rollers that fall and the ones that are already inside the collector.

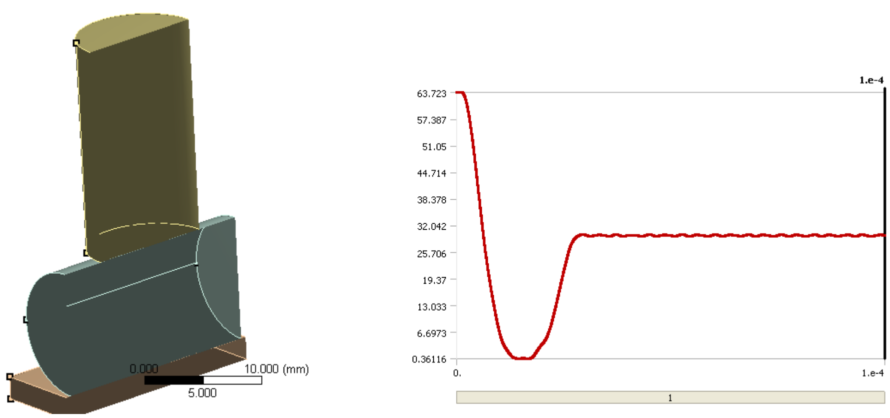
Generally collisions are short-term phenomena (interaction takes a finite time) during which two or more body exchange momentum and energy between them. Interaction length is small enough so that external forces do not produce a change in system momentum. In this paper the contact time is considered t = $1e^{-4}$ [s].

2. Experimental Results

In the collision process there are two phases:

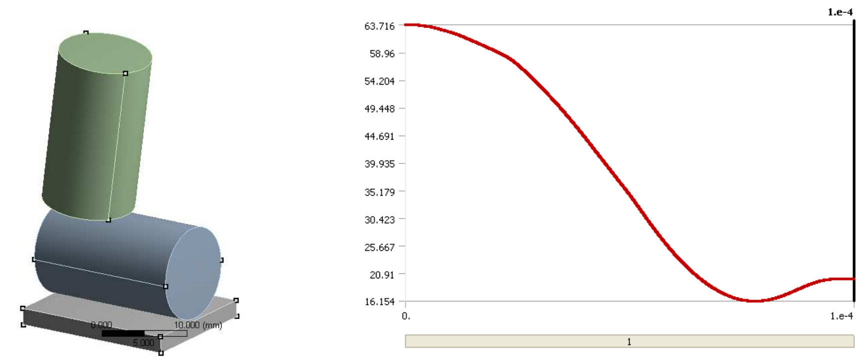
1. Compression stage in which kinetic energy of relative motion is converted in deformation potential energy and other non mechanical forms of energy (thermal).

2. Separation phase in which the bodies depart one from another, breaking the contact, and the relative velocity increases, the deformation is reduced, the bodies are searching to return at original shape.



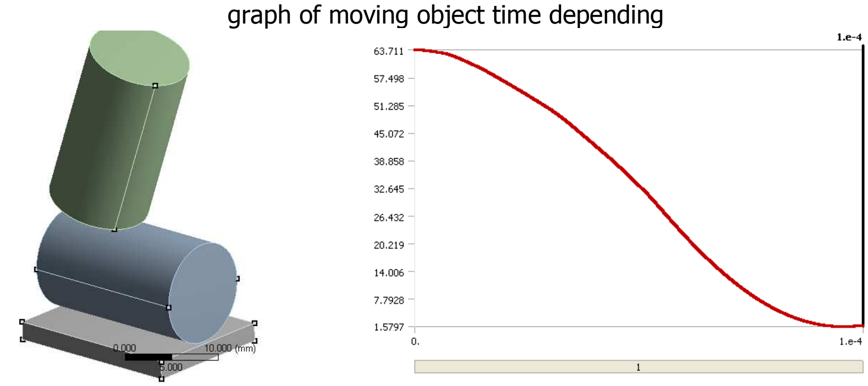
a) b)

Figure 2. a) Rollers impact under a 0° angle and b) dissipated kinetic energy graph of moving object time depending



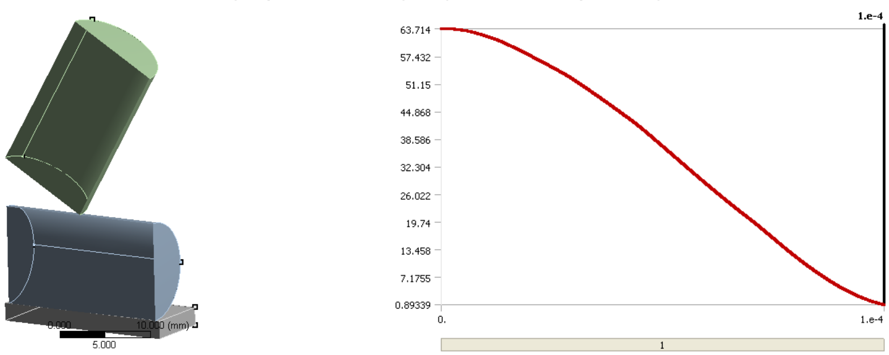
a) b)

Figure 3. a) Rollers impact under a 10° angle and b) dissipated kinetic energy graph of moving object time depending



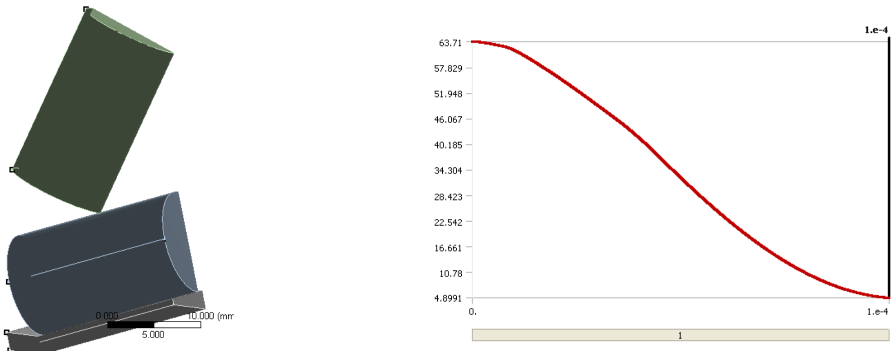
a) b)

Figure 4. a) Rollers impact under a 20° angle and b) dissipated kinetic energy graph of moving object time depending



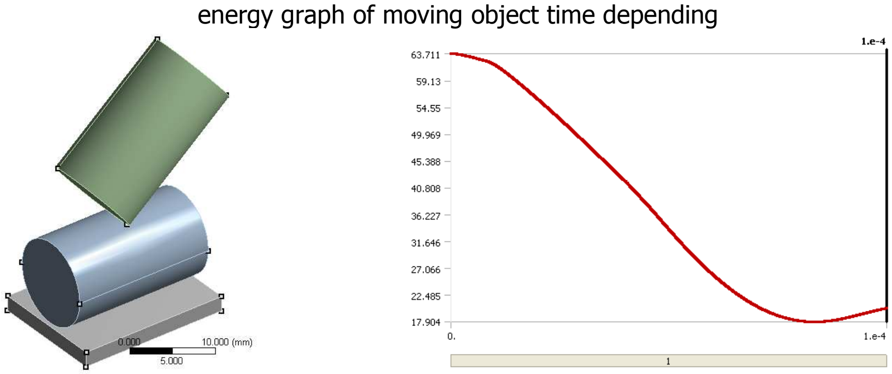
a) b)

Figure 5. a) Rollers impact under a 30° angle and b) dissipated kinetic energy graph of moving object time depending



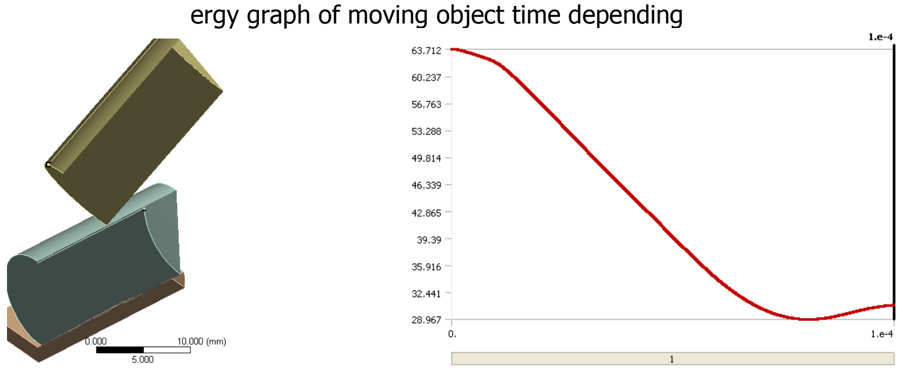
a) b)

Figure 6. a) Rollers impact under a 40° angle and b) dissipated kinetic energy graph of moving object time depending



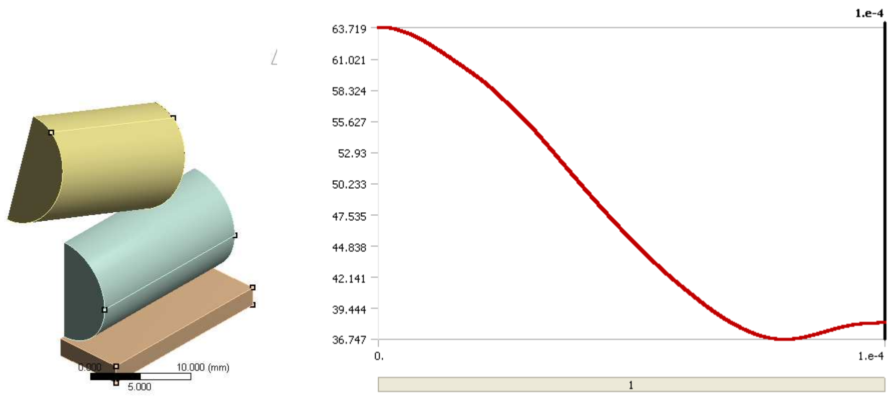
a) b)

Figure 7. a) Rollers impact under a 50° angle and b) dissipated kinetic energy graph of moving object time depending



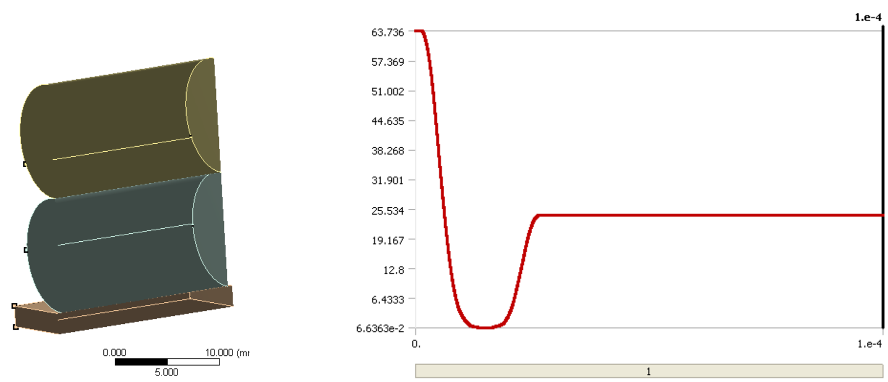
a) b)

Figure 8. a) Rollers impact under a 60° angle and b) dissipated kinetic energy graph of moving object time depending



a) b)

Figure 9. a) Rollers impact under a 70° angle and b) dissipated kinetic energy graph of moving object time depending



a) b)

Figure 10. a) Rollers impact under a 90° angle and b) dissipated kinetic energy graph of moving object time depending

3. Conclusion

The dynamic analysis presented above regarding this phenomenon was very concluding. The slope of dissipated kinetic energy is variable with impact angle and cyclic. The separation phase is variable in time.

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