A GEOMETRIC AND PROBABLISTIC APPROACH TO THE FILTRATION OF RODS

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The key to any filtration process is jamming; in order to filter rocks from water a mesh must be developed that will allow the water to pass through but will cause the rocks to jam or get stuck. However not all systems are this simple. Take a system of many rods, how can one type of rod be filtered from the system? At first the solution to this may seem simple such as with the rocks, however it turns out to be much more complicated. Since rods can take any orientation going through the mesh, the rods will never jam 100% of the time. Knowing this, what is the probability that a single rod will jam when passing through a mesh? A strictly geometric approach can be taken to answer this question. To begin to answer this question the probability of the rod simply intersecting the mesh - not necessarily jamming - can be investigated. After working through this theory, called the Buffon-Laplace Needle Problem, adjustments were made to account for a third dimension and to approximate when these intersections were equivalent to jams. The theory was then compared to an experiment which was being run in parallel.