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Saugata Basu* (sbasu@math.purdue.edu), Purdue University, Department of Mathematics, 150 N. University St., West Lafayette, IN 47907, and **Thierry Zell**. *Polynomial hierarchy, Betti numbers and a real analogue of Toda's theorem.*

We study the relationship between the computational hardness of two well-studied problems in algorithmic semi-algebraic geometry – namely the problem of deciding sentences in the first order theory of reals with a constant number of quantifier alternations, and that of computing Betti numbers of semi-algebraic sets. We obtain a polynomial time reduction of the compact version of the first problem to the second. As a consequence we obtain an analogue of Toda's theorem from discrete complexity theory for real Turing machines (in the sense of Blum, Shub and Smale). (Received February 02, 2009)