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## ZEROS OF POLYNOMIALS WITH 0, 1 COEFFICIENTS

by A.M. ODLYZKO and B. POONEN<sup>1</sup>

**ABSTRACT.** Zeros of polynomials with 0, 1 coefficients exhibit many interesting features, including fractal appearance. This paper obtains bounds for such zeros. It shows that zeros with a sufficiently large negative real part are real. It also proves that the closure of the set of these zeros is path connected.

### 1. INTRODUCTION

Zeros of polynomials with random coefficients occur in many scientific and engineering problems. A general overview of the subject and references can be found in the book of Bharucha-Reid and Sambandham [4], which is the basic reference on this topic. There is a wealth of information about distribution of zeros in the complex plane and on the real line. Almost all of the results are for coefficients chosen independently from a common distribution that is continuous, and usually Gaussian.

In this paper we consider zeros of polynomials with 0, 1 coefficients. These zeros have some features that distinguish them from those of the commonly considered families of random polynomials. Let

$$(1.1) \quad P = \left\{ f(z) : f(z) = 1 + \sum_{j=1}^d a_j z^j, \quad a_j = 0 \text{ or } 1 \text{ for all } j \right\}.$$

(We exclude polynomials with constant term 0, as their zeros, other than 0, are those of polynomials of lower degree with coefficients 0, 1.) Define

$$(1.2) \quad W = \{z \in \mathbf{C} : f(z) = 0 \text{ for some } f \in P\}.$$

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