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ZEROS OF POLYNOMIALS WITH 0, 1 COEFFICIENTS

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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

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

(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

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

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