# Vandermonde matrices for intersection points of curves

Hakop Hakopian, Kurt Jetter and Georg Zimmermann

## Abstract

We reconsider and reprove Cayley-Bacharach type theorems, as discussed in [1], Theorems CB1-CB5. Our proof naturally uses Max Noether's famous basis theorem for finitely generated polynomial ideals, but in addition only involves rank properties of Vandermonde matrices. In this way, we even arrive at a slight extension of Theorem CB5. Applications to poised or non-poised problems of multivariate polynomial interpolation are also discussed.

**Keywords:** Cayley-Bacharach, Max Noether's basis theorem, Hilbert function, polynomial interpolation, poised, multivariate.

**MSC:** Primary 41A05, 41A63; Secondary 14H50.

## §1. Introduction

The purpose of this short note is a new proof and a slight extension of the Cayley-Bacharach type theorems as stated, e.g., in [1], Theorems CB1-CB5. Our analysis is based, naturally, on Max Noether's famous "$AF+BG$"-theorem, but in addition will only use rank properties of Vandermonde matrices, and properties of point sets which will be derived from these. We will not rely on the famous Riemann-Roch theorem, nor do we focus on an extension to more abstract versions of Cayley-Bacharach (as paper [1] does). Instead, we will be satisfied with a rather straightforward understanding of these problems