

**MEETING ON TOMOGRAPHY AND
APPLICATIONS
MATHEMATICS DEPARTMENT, POLITECNICO DI MILANO
MARCH 21-23, 2016**

BOOK OF ABSTRACTS

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On grain indexing and reconstruction

ABSTRACT The problem of identifying granular structures is of basic interest in material sciences.

The present talk deals with two fundamental problems in this field.

First, we develop a mathematical model for grain indexing i.e., for identifying the position and orientation of small crystals (grains) within bulk materials from their images (spots) under X-ray diffraction tomography. We establish and then use the connection of the underlying tasks to problems from the geometry of numbers and combinatorial optimization to give various results on the uniqueness and computational complexity of reconstruction. Also we outline algorithms that are based on hypergraph matchings.

Second, we show how to handle the discrete inverse problem of detecting the geometry of polycrystals (grain maps), based only on few measured parameters (volume, center and, possibly, moments) for each grain. We develop anisotropic diagrams based on geometric clusterings that turn out to provide appropriate tools.

(The first part is joint work with A. Alpers, G. Heise and A. Taraz; the second part is joined work with A. Alpers, A. Brieden, A. Lyckegaard and H. Poulsen)