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PREFACE

Alicia Golebiewska Herrmann

On 7 December 1983, Alicia Golebiewska Herrmann died at the age of 42, after a long and heroic struggle with cancer. With Alicia's passing away, the mechanics community lost one of its most cherished members. Moved by a desire to publicly record their esteem for Alicia, a number of her friends in the scientific world suggested that a special issue of the *International Journal of Solids and Structures*, of which she was Associate Editor, be devoted to her memory. This desire has materialized in the present issue of the *Journal*.

General information on A. Golebiewska Herrmann's life is contained in the obituary which was published in Volume 20 of this *Journal*. Here, we would like to summarize her scientific contributions.

Golebiewska Herrmann's first significant series of papers [1–4, 6, 8, 9] is devoted to the nonlocal theory of dislocations. The classical continuum theory of dislocations is an asymptotic theory which is valid at sufficiently large distances, but fails at interatomic distances. To overcome this difficulty, the nonlocal theory of elasticity based on the notion of a pseudocontinuum was developed. This approach permits one to describe discrete systems, such as crystal lattices, using analytical mathematical techniques analogous to those of continuum mechanics. Golebiewska Herrman skillfully applied the nonlocal theory to solving important problems in dislocation theory. In particular, she calculated the energy of dislocation segments, loops, and defects in dislocation lines, such as kinks and jogs, as well as the interaction energy between dislocation loops.

In the series of papers [15, 17, 19, 20, 23], Golebiewska Herrmann studied the dual roles played by actual forces and forces on defects (in the sense of Eshelby). Actual (or "physical," in Golebiewska's terminology) forces are associated with the motion and deformation of matter, and contribute to the balance equation of linear momentum. "Material" forces are connected with changes in the location of defects within a material and manifest themselves mathematically in a differential equation for the balance of *material momentum*. For media that admit a Lagrangian function, Golebiewska Herrmann showed that both physical and material balance laws can be obtained through a unified variational approach. The balance of material momentum, which involves the material momentum tensor, is related to path-independent integrals of the type used in fracture mechanics. These connections were explored in [17, 19, 23] and further investigated in [22, 26]. Related work on energy-release rates in fracture mechanics is contained in [16, 18, 24].

An important group of works by Golebiewska Herrmann is concerned with the gauge approach to defect dynamics. Gauge theoretical ideas have proved to be of fundamental importance in modern physics. Gauge field theories are considered as the most powerful method of describing interactions between elementary particles. Golebiewska Herrmann was one of the first to discover the deep analogy between the gauge transformations in electrodynamics and those in dislocation theory. In her works[11, 14] and the article [12] in collaboration with Edelen, the gauge invariance of the (linear) dynamical theory of dislocations and disclinations was studied in detail. These works initiated a large number of investigations in the gauge theory of defects in solids.

Alicia was not only a scientist with exceptional physical intuition, but she was also actively involved in the social and scientific life of the mechanics community. Her life was short, but it was full and rewarding. She will be dearly missed by all those who have had the privilege of knowing her.

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