Valerio Pascucci, Ph.D.
Endowed Chair of the University of Utah
Director, CEDMAV, University of Utah
Faculty, SCI, University of Utah
Professor, School of Computing, University of Utah
Laboratory Fellow, PNNL
Telephone: (801) 5879885
Email: pascucci@sci.utah.edu

January 3, 2022

To anyone who may be concerned,

With this letter, I would like to provide my unwavering support for the recognition of Prof. Paoluzzi to the rank of professor emeritus. Before coming to the United States, I knew Prof. Paoluzzi as a professor at the University of Rome "La Sapienza." I continued to collaborate intermittently with Prof. Paoluzzi, but I always followed his research activities, and I can attest to his prominence in the research community because of his uniquely impactful work in the space of Computer Aided Design, Geometric Modeling, Computational Geometry, and Computational Topology. Prof. Paoluzzi has also been an exceptional mentor and helped many students to gain prominence on their own. Roberto Scopigno (ISTI Director of Italian National Research Council in Pisa) and Fausto Bernabini (Senior Director of Worldwide Site Reliability Engineering at Google) are primary examples of the legacy of academic excellence that Prof. Paoluzzi has achieved both in research and industry.

For this recommendation, I assume that the main criteria of focus are academic excellence and prominence in the research community. In particular, I will highlight key aspects of Prof. Paoluzzi's outstanding scholarship record that earned him a first-class international reputation. The overarching theme of Prof. Paoluzzi's research has been geometric modeling. The early influential work involved a number of techniques combining advanced solid modeling (C. Cattani and A. Paoluzzi, "A topological approach to space-time modeling," in System Modeling and Simulation, T. Tzafestas, A. Eisenberg, and L. Carotenuto, Eds. Elsevier Science, 1989) and parallel graphics techniques (A. Paoluzzi, M. Rosina, and R. Scopigno, "A model for parallel processing of graphics," Rivista di Informatica, 1988, and R. Scopigno, A. Paoluzzi, S. Guerrini, and G. Rumolo, "Parallel depth-merge: A paradigm for hidden surface removal," Computers & Graphics, 1993.). In addition to theoretical and algorithmic work, Prof. Paoluzzi was one of the first to see the value of building community tools that can be freely shared in the community. In particular, the result of this line of research was deployed in the solid modeling system "Minerva" (A. Paoluzzi and M. Masia, "The geometric modeler Minerva, Wheels for the Mind," Apple Europe, 1989), which was used both as a way to demonstrate the novel algorithms and data structures developed, and as an educational tool for university classes. The value of this work is not only validated by the numerous

publications and presentations but also by the collaboration initiated with renowned computer scientist John Hopcroft at Cornell.

The early Minerva work evolved into a new modeling paradigm that generalizes to simplicial complexes in any dimension (V. Ferrucci and A. Paoluzzi, “Extrusion and boundary evaluation for multidimensional polyhedra," Computer-Aided Design, 1991. and F. Bernardini, V. Ferrucci, and A. Paoluzzi, “Working with dimension-independent polyhedra," in Second SIAM Conference on Geometric Design, Tempe, Arizona, 1991). This approach connects a rigorous formal approach to modeling with practical applications that range from architectural design and motion planning in robotics, where high-dimensional configuration spaces need to be used routinely. This work was also released in a software package called *Simplex*^{N} (A. Paoluzzi, F. Bernardini, C. Cattani, and V. Ferrucci. “Dimension-independent modeling with simplicial complexes,” ACM Trans. on Graphics, 12(1):56–102, 1993) using an innovative Common Lisp implementation. While the practical effectiveness of this approach is undisputed, a major challenge remained to deal with the complexity of expressing high dimensional constructs in a specialized way that could be managed only by a few experts in the field. Prof. Paoluzzi addressed this challenge by introducing a high-level programming language that allowed for solid modeling data structures and algorithms to be considered first-class citizens as basic data types and operators. This vision was implemented in the PLASM language (F. Bernardini, V. Ferrucci, and A. Paoluzzi, “*SimplexL*: A language for manipulating multidimensional polyhedra,” in IcoGraphics '92. Milano, Italy: Mondadori Informatica, 1992 and A. Paoluzzi and C. Sansoni, “Symbolic modeling of architectural design with PLASM language,” in CAAD Futures '91, G. Schmitt, Ed. Zurich, Swiss: Vieweg Verlag, 1992.) This line of research flourished in a large number of publications and finally in the publication of the book “Geometric Programming for Computer-Aided Design” by Wiley, of which he is the sole author. This book is an impressive collection of theoretical constructs and practical examples that can be used in class teaching as guidance for research in various topics, including geometric programming, linear algebra, polyhedral geometry, differential geometry, graphics, and parametric and solid modeling. The distribution in conjunction with the software package PLaSM in Common Lisp and, later on, Py PLaSM in Python, facilitated its adoption in several research groups and as a teaching tool. In my estimate, this vision of combining robust geometric modeling techniques with a high-level programming paradigm remains an unsurpassed accomplishment.

Recent research has evolved into further advancing robust modeling with computational topology algorithms to discover space partitions induced in lower-dimensional boundary and chain representations. This new methodology, founded in algebraic topology, allows using sparse vectors and matrices to compute both spaces and maps of chain complexes (A. Paoluzzi, V. Shapiro, A. DiCarlo, F. Furiani, G. Martella, and G. Scorzelli, “Topological computing of arrangements with (co)chains,” ACM Transactions on Spatial Algorithms and Systems, 2020). In addition to classical application in 3D graphics and 3D printing, Prof. Paoluzzi has spearheaded its use in biological and medical applications as well as computations in parallel (M. Jirik and A. Paoluzzi, “Algebraic filtering of surfaces from 3d medical images with Julia,” in 20th International Conference on Computer-Aided Design and Applications, 2020). The corresponding software is written in Julia, and introduces a novel language for scientific computing.

Prof. Paoluzzi remains very active today and continues to be highly regarded by the scientific community. He has been inducted as a “Pioneer” of Solid Modeling Association (SMA) and is an active member of the Editorial Boards of the Computer-Aided Design Journal (Elsevier) and the Computer-Aided Design and Applications Journal (Taylor&Francis).

CEDMAV
Center for Extreme Data Management and Visualization-Office of the Director
72 S Central Campus Drive, Room 3750. Salt Lake City, UT 84112. Phone: 801-585-1867 Fax: 801-585-6513
THE UNIVERSITY OF UTAH

In conclusion, Prof. Paoluzzi is genuinely a leader of his research community. I would strongly recommend providing him with the rank of professor emeritus as he undoubtedly would be given this position in any top university in the United States. Please let me know if you need any additional information.

Sincerely,

Valerio Pascucci, Ph.D.

John R. Parks Inaugural Endowed Chair of the University of Utah
Director, Center for Extreme Data Management Analysis & Visualization
Professor, Scientific Computing & Imaging Institute, University of Utah
DOE Laboratory Fellow at Pacific Northwest National Laboratory