

## Prof. SONGÜL KAYA MERDAN

### Personal Information

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### International Researcher IDs

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Publons / Web Of Science ResearcherID: J-2503-2012

ScopusID: 13407549500

Yoksis Researcher ID: 164959

### Education Information

Doctorate, University of Pittsburgh, Matematik, United States Of America 1999 - 2004

Postgraduate, Ankara University, Fen Fakültesi, Matematik Bölümü, Turkey 1995 - 1998

Undergraduate, Ankara University, Fen Fakültesi, Matematik Bölümü, Turkey 1990 - 1994

### Dissertations

Doctorate, Numerical Analysis of a Variational Multiscale Method for Turbulence, University Of Pittsburgh, 2004

Postgraduate, Diferensiyel Denklemlerin Sınımlı Çözümleri, Ankara Üniversitesi, 1998

### Research Areas

Natural Sciences

### Academic Titles / Tasks

Professor, Middle East Technical University, Faculty Of Arts And Sciences, Department Of Mathematics, 2015 - 2023

### Academic and Administrative Experience

Fakülte Yönetim Kurulu Üyesi, Middle East Technical University, Faculty of Arts and Sciences, 2017 - Continues

Academic Performance D. Board Member, Middle East Technical University, Faculty of Arts and Sciences, Department of Mathematics, 2018 - 2018

Middle East Technical University, Faculty of Arts and Sciences, Department of Mathematics, 2006 - 2011

### Advising Theses

KAYA MERDAN S., Second order numerical methods for Navier-Stokes and Darcy-Brinkman equations, Doctorate, M.DEMİR(Student), 2022

Kaya Merdan S., Mathematical modelling of blood flow through arteries and investigation of some pathological cases in cardiovascular system using grad-div stabilization, Postgraduate, İ.TAHİR(Student), 2019

KAYA MERDAN S., Reduced order modelling for multiphysics problems, Doctorate, F.GÜLER(Student), 2018

KAYA MERDAN S., Analysis of a projection-based variational multiscale method for a linearly extrapolated BDF2 time discretization of the navier-stokes equations, Postgraduate, D.VARGÜN(Student), 2018

KAYA MERDAN S., Numerical methods for multiphysics flow problems, Doctorate, M.AKBAŞ(Student), 2016

KAYA MERDAN S., Fully computable convergence analysis of discontinuous galerkin finite element approximation with an arbitrary number of levels of hanging nodes, Doctorate, S.ÖZİŞİK(Student), 2012

KAYA MERDAN S., Numerical analysis of a projection-based stabilization method for the natural convection problems, Doctorate, A.BAYRAM(Student), 2011

KAYA MERDAN S., Modern mathematical methods in modeling and dynamics of regulatory systems of gene-environment networks, Doctorate, Ö.DEFTERLİ(Student), 2011

## Jury Memberships

PhD Thesis Monitoring Committee Member, PhD Thesis Monitoring Committee Member, Orta Doğu Teknik Üniversitesi, December, 2021

PhD Thesis Monitoring Committee Member, PhD Thesis Monitoring Committee Member, Gazi Üniversitesi, December, 2021

## Published journal articles indexed by SCI, SSCI, and AHCI

- I. **On an optimal control problem of the Leray- $\alpha$  model**  
Hacat G., Çıbık A. B., Yılmaz F. N., Kaya Merdan S.  
Journal of Computational and Applied Mathematics, vol.436, 2024 (SCI-Expanded)
- II. **Deferred correction method for the continuous data assimilation model**  
AĞGÜL M., Çıbık A., Eroglu F. G., KAYA MERDAN S.  
Computer Methods in Applied Mechanics and Engineering, vol.415, 2023 (SCI-Expanded)
- III. **An Improved Arrow-Hurwicz Method for the Steady-State Navier-Stokes Equations**  
Takhirov A., Çıbık A. B., Eroğlu F. G., Kaya Merdan S.  
Journal of Scientific Computing, vol.96, no.2, 2023 (SCI-Expanded)
- IV. **Artificial compression method for MHD system in Elsässer variables**  
Aggul M., Eroglu F. G., Merdan S.  
Applied Numerical Mathematics, vol.185, pp.72-87, 2023 (SCI-Expanded)
- V. **Time filtered second order backward Euler method for EMAC formulation of Navier-Stokes equations**  
DEMİR M., Çıbık A., KAYA MERDAN S.  
Journal of Mathematical Analysis and Applications, vol.516, no.2, 2022 (SCI-Expanded)
- VI. **Error estimates for the optimal control of Navier-Stokes equations using curvature based stabilization**  
Hacat G., Yılmaz F. N., Çıbık A. B., Kaya Merdan S.  
Applied Mathematics and Computation, vol.430, 2022 (SCI-Expanded)
- VII. **On the performance of curvature stabilization time stepping methods for double-diffusive natural convection flows in the presence of magnetic field**  
Cibik A., Eroglu F. G., KAYA MERDAN S.  
Numerical Algorithms, vol.88, no.1, pp.475-498, 2021 (SCI-Expanded)
- VIII. **Defect-deferred correction method based on a subgrid artificial viscosity model for fluid-fluid**

**interaction**

AĞGÜL M., Kaya S.

Applied Numerical Mathematics, vol.160, pp.178-191, 2021 (SCI-Expanded)

- IX. **An analysis of a linearly extrapolated BDF2 subgrid artificial viscosity method for incompressible flows**  
DEMİR M., Kaya S.  
Applied Numerical Mathematics, vol.156, pp.140-157, 2020 (SCI-Expanded)
- X. **A projection based variational multiscale method for a fluid–fluid interaction problem**  
AĞGÜL M., EROĞLU F. G., Kaya S., Labovsky A. E.  
Computer Methods in Applied Mechanics and Engineering, vol.365, 2020 (SCI-Expanded)
- XI. **A second order decoupled penalty projection method based on deferred correction for MHD in Elsasser variable**  
Erkmen D., Kaya S., Cibik A.  
JOURNAL OF COMPUTATIONAL AND APPLIED MATHEMATICS, vol.371, 2020 (SCI-Expanded)
- XII. **Analysis of Second Order Time Filtered Backward Euler Method for MHD Equations**  
Cibik A., EROĞLU F. G., Kaya S.  
Journal of Scientific Computing, vol.82, no.2, 2020 (SCI-Expanded)
- XIII. **LONG TIME STABILITY OF A LINEARLY EXTRAPOLATED BLENDED BDF SCHEME FOR MULTIPHYSICS FLOWS**  
Cibik A., Eroglu F. G., Kaya S.  
INTERNATIONAL JOURNAL OF NUMERICAL ANALYSIS AND MODELING, vol.17, no.1, pp.24-41, 2020 (SCI-Expanded)
- XIV. **Two approaches to creating a turbulence model with increased temporal accuracy**  
Aggul M., Kaya S., Labovsky A. E.  
Applied Mathematics and Computation, vol.358, pp.25-36, 2019 (SCI-Expanded)
- XV. **POD-ROM for the Darcy-Brinkman equations with double-diffusive convection**  
Eroglu F. G., Kaya S., Rebholz L. G.  
JOURNAL OF NUMERICAL MATHEMATICS, vol.27, pp.123-139, 2019 (SCI-Expanded)
- XVI. **A family of second order time stepping methods for the Darcy-Brinkman equations**  
Cibik A., DEMİR M., KAYA MERDAN S.  
JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS, vol.472, no.1, pp.148-175, 2019 (SCI-Expanded)
- XVII. **FINITE ELEMENT ERROR ANALYSIS OF A MANTLE CONVECTION MODEL**  
John V., KAYA MERDAN S., Novo J.  
INTERNATIONAL JOURNAL OF NUMERICAL ANALYSIS AND MODELING, vol.15, pp.677-698, 2018 (SCI-Expanded)
- XVIII. **A modular regularized variational multiscale proper orthogonal decomposition for incompressible flows**  
Eroglu F. G., Kaya S., Rebholz L. G.  
COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING, vol.325, pp.350-368, 2017 (SCI-Expanded)
- XIX. **On the stability at all times of linearly extrapolated BDF2 timestepping for multiphysics incompressible flow problems**  
AKBAŞ M., KAYA S., Rebholz L. G.  
NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS, vol.33, no.4, pp.999-1017, 2017 (SCI-Expanded)
- XX. **NUMERICAL ANALYSIS AND TESTING OF A FULLY DISCRETE, DECOUPLED PENALTY-PROJECTION ALGORITHM FOR MHD IN ELSASSER VARIABLE**  
AKBAŞ M., KAYA MERDAN S., MOHEBUJJAMAN M., rebholz l.  
INTERNATIONAL JOURNAL OF NUMERICAL ANALYSIS AND MODELING, vol.13, no.1, pp.90-113, 2016 (SCI-Expanded)
- XXI. **Analysis of Model Variance for Ensemble Based Turbulence Modeling**  
Jiang N., Kaya S., Layton W.  
COMPUTATIONAL METHODS IN APPLIED MATHEMATICS, vol.15, no.2, pp.173-188, 2015 (SCI-Expanded)

- XXII. **An Explicitly Decoupled Variational Multiscale Method for Incompressible, Non-Isothermal Flows**  
Belenli M. A., Kaya S., Rebholz L. G.  
COMPUTATIONAL METHODS IN APPLIED MATHEMATICS, vol.15, no.1, pp.1-20, 2015 (SCI-Expanded)
- XXIII. **On Crank-Nicolson Adams-Bashforth timestepping for approximate deconvolution models in two dimensions**  
Kaya S., Manica C. C., Rebholz L. G.  
APPLIED MATHEMATICS AND COMPUTATION, vol.246, pp.23-38, 2014 (SCI-Expanded)
- XXIV. **A subgrid stabilization finite element method for incompressible magnetohydrodynamics**  
Belenli M. A., KAYA MERDAN S., Rebholz L. G., Wilson N. E.  
INTERNATIONAL JOURNAL OF COMPUTER MATHEMATICS, vol.90, no.7, pp.1506-1523, 2013 (SCI-Expanded)
- XXV. **Finite element analysis of a projection-based stabilization method for the Darcy-Brinkman equations in double-diffusive convection**  
Cibik A., KAYA MERDAN S.  
APPLIED NUMERICAL MATHEMATICS, vol.64, pp.35-49, 2013 (SCI-Expanded)
- XXVI. **CONVERGENCE ANALYSIS OF THE FINITE ELEMENT METHOD FOR A FUNDAMENTAL MODEL IN TURBULENCE**  
KAYA MERDAN S., C C M.  
MATHEMATICAL MODELS & METHODS IN APPLIED SCIENCES, vol.22, no.11, 2012 (SCI-Expanded)
- XXVII. **A projection-based stabilized finite element method for steady-state natural convection problem**  
Cibik A., KAYA MERDAN S.  
JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS, vol.381, no.2, pp.469-484, 2011 (SCI-Expanded)
- XXVIII. **Finite element error analysis for a projection-based variational multiscale method with nonlinear eddy viscosity**  
John V., KAYA MERDAN S., Kindl A.  
JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS, vol.344, no.2, pp.627-641, 2008 (SCI-Expanded)
- XXIX. **Finite element error analysis of a variational multiscale method for the Navier-Stokes equations**  
Volker J., KAYA MERDAN S.  
ADVANCES IN COMPUTATIONAL MATHEMATICS, vol.28, no.1, pp.43-61, 2008 (SCI-Expanded)
- XXX. **Finite element error analysis of a zeroth order approximate deconvolution model based on a mixed formulation**  
Carolina Cardoso M., KAYA MERDAN S.  
JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS, vol.331, no.1, pp.669-685, 2007 (SCI-Expanded)
- XXXI. **A two-grid stabilization method for solving the steady-state Navier-Stokes equations**  
KAYA MERDAN S., Rivière B.  
NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS, vol.22, no.3, pp.728-743, 2006 (SCI-Expanded)
- XXXII. **A two-level variational multiscale method for convection-dominated convection-diffusion equations**  
Volker J., KAYA MERDAN S., Layton W.  
COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING, vol.195, pp.4594-4603, 2006 (SCI-Expanded)
- XXXIII. **Subgrid stabilized defect correction methods for the Navier-Stokes equations**  
KAYA MERDAN S., William L., Béatrice R.  
SIAM JOURNAL ON NUMERICAL ANALYSIS, vol.44, no.4, pp.1639-1654, 2006 (SCI-Expanded)
- XXXIV. **A finite element variational multiscale method for the Navier-Stokes equations**  
Volker J., KAYA MERDAN S.  
SIAM JOURNAL ON SCIENTIFIC COMPUTING, vol.26, no.5, pp.1485-1503, 2005 (SCI-Expanded)
- XXXV. **A discontinuous subgrid eddy viscosity method for the time-dependent Navier-Stokes equations**  
KAYA MERDAN S., Béatrice R.  
SIAM JOURNAL ON NUMERICAL ANALYSIS, vol.43, no.4, pp.1572-1595, 2005 (SCI-Expanded)

- I. **On the extrapolated VMS-POD method for incompressible flows**  
GÜLER EROĞLU F., KAYA MERDAN S.  
Computer Methods in Materials Science, vol.19, pp.70-77, 2019 (Scopus)
- II. **Decoupled Modular Regularized VMS-POD for Darcy-Brinkman Equations**  
Güler Eroğlu F., Kaya Merdan S., Rebholz L. G.  
IAENG International Journal of Applied Mathematics, vol.49, pp.134-144, 2019 (Scopus)

## Books & Book Chapters

- I. **An Extrapolated Crank Nicholson VMS-POD Method for Darcy Brinkman Equations**  
GÜLER EROĞLU F., KAYA MERDAN S.  
in: Numerical Solutions of Realistic Nonlinear Phenomena. Nonlinear Systems and Complexity, Machado J., Özdemir N., Baleanu D., Editor, Springer, Cham, cham, pp.25-51, 2020
- II. **Numerical Studies on a Second Order Explicitly Decoupled Variational Multiscale Method**  
AKBAŞ BELENLİ M., KAYA MERDAN S., Rebholz L.  
in: Numerical Mathematics and Advanced Applications ENUMATH 2015, Karasözen, B., Manguoğlu, M., Tezer-Sezgin, M., Göktepe, S., Uğur, Ö, Editor, Springer, pp.115-122, 2016
- III. **Numerical Analysis of a Variational Multiscale Method for Turbulence**  
KAYA MERDAN S.  
LAP LAMBERT Academic Publishing, 2011

## Refereed Congress / Symposium Publications in Proceedings

- I. **ON THE EXTRAPOLATED VMS-POD METHOD FOR INCOMPRESSIBLE FLOWS**  
Güler Eroğlu F., Kaya Merdan S.  
5th ECCOMAS Young Investigators Conference, Krakow, Poland, 1 - 06 September 2019, vol.19, pp.70-77
- II. **A Numerical Study of a Modular Sparse Grad-Div Stabilization Method for Boussinesq Equations**  
DEMİR M., KAYA MERDAN S.  
8th International Conference on Mathematical Modeling in Physical Science, 26 - 29 August 2019, vol.2019, pp.1-4
- III. **Numerical Investigation of the Boussinesq equations through a Subgrid Artificial Viscosity Method**  
DEMİR M., KAYA MERDAN S.  
The European Conference on Numerical Mathematics and Advanced Applications (ENUMATH 2019), Egmond aan Zee, Netherlands, 30 September - 04 October 2019
- IV. **A Review of Variational Multiscale Methods for Multiphysics Flow Problems**  
KAYA MERDAN S.  
International Meeting on Applied Mathematics Evolution, 16 - 18 April 2019
- V. **Numerical Aspects of POD-Based Reduced-Order Modeling for Darcy-Brinkman Equations**  
GÜLER EROĞLU F., KAYA MERDAN S.  
Workshop on Computational Science and Engineering, Ankara, Turkey, 20 - 21 October 2018
- VI. **A Numerical Study of Second Order Time Stepping Methods for the Boussinesq Equations**  
DEMİR M., ÇIBİK A. B., KAYA MERDAN S.  
BEYOND: Workshop on Computational Science and Engineering, Turkey, 20 - 21 October 2018
- VII. **A Projection-Based VMS Method on Linearly Extrapolated BDF2 Time-stepping Scheme for Navier-Stokes Equations**  
KAYA MERDAN S., Vargün D.  
BEYOND: Workshop on Computational Science and Engineering, Turkey, 20 - 21 October 2018
- VIII. **penalty projection algorithm for MHD in Elsasser Variable,**  
KAYA MERDAN S.  
world congress of mathematics, 1 - 09 August 2018

- IX. **A Numerical Investigation of VMS-POD Model for Darcy-Brinkman Equations**  
GÜLER EROĞLU F., KAYA MERDAN S., rebholz l.  
World Congress on Engineering 2018, 4 - 06 July 2018, vol.1
- X. **Numerical analysis of a Family of Second Order Time Stepping Methods for Boussinesq Equations**  
ÇIBIK A. B., DEMİR M., KAYA MERDAN S.  
World Congress on Engineering 2018,, 4 - 06 July 2018, vol.1, pp.56-59
- XI. **Numerical Study on Blood Flow Modelling in Arteries**  
KAYA MERDAN S., ökten i. t.  
International Conference on Applied Mathematics in Engineering, 27 - 29 June 2018
- XII. **Proper Orthogonal Decomposition Method for the Darcy-Brinkman Equations**  
GÜLER EROĞLU F., KAYA MERDAN S.  
International Conference on Applied Mathematics in Engineering, 27 - 29 June 2018
- XIII. **Numerical Analysis of Second Order Time Stepping Methods for the Natural Convection Problems**  
Demir M., Çıbık A. B., Kaya Merdan S.  
International Conference on Applied Mathematics in Engineering,, Balıkesir, Turkey, 27 - 29 June 2018, pp.100
- XIV. **Doşal Konveksiyon Problemleri için ikinciMertebeden Zaman Admlamas YöntemleriAilesinin Saysal Analizi**  
DEMİR M., ÇIBIK A. B., KAYA MERDAN S.  
13. Ankara Matematik Günleri, Turkey, 27 - 28 May 2018
- XV. **Modeling of blood flow in arteies with Navier-Stokes equations**  
KAYA MERDAN S.  
5th International Conference on Complex Dynamical Systems in Life sciences Modeling and Analysis, 10 - 12 May 2018
- XVI. **Variational Multiscale Proper Orthogonal Decomposition with Modular Regularization**  
GÜLER EROĞLU F., KAYA MERDAN S., Rebholz L.  
CMMSE Spain 2017, Cadiz, Spain, 4 - 08 July 2017, pp.854-857
- XVII. **Sıkıştırılmaz akışlar içinprojeksiyona bağlı çok ölçekli varyasyonel uygun dik ayrıştırma metodu**  
GÜLER EROĞLU F., KAYA MERDAN S.  
AMG Turkey 2017, Ankara, Turkey, 25 - 26 May 2017, pp.20
- XVIII. **Projeksiyona Dayalı Çok ÖlçekliVaryasyonel Uygun Dik Ayrıştırma metodunun Modüler Regülerizasyonu**  
GÜLER EROĞLU F., KAYA MERDAN S.  
IV.Kadın Matematikçiler Derneği Çalıştayı, Turkey, 28 - 29 April 2017
- XIX. **Numerical Analysis of a Fully Discrete Decoupled Penalty -Projection Algorithm for MHD in Elsässer Variables.**  
KAYA MERDAN S.  
Fall Western Sectional Meeting (AMS-Meeting #1122), 8 - 09 October 2016
- XX. **Projeksiyona Bağlı Modüler Regülerizasyonlu ve Ortogonal Ayrıştırma Metodunun Sayısal Analizi**  
Güler F., KAYA MERDAN S.  
11. Ankara Matematik Günleri, Turkey, 26 - 27 May 2016, pp.1
- XXI. **Numerical Studies on a Second Order Explicitly Decoupled Variational Multiscale Method**  
Akbas M., KAYA MERDAN S., Rebholz L.  
European Conference on Numerical Mathematics and Advanced Applications (ENUMATH), Ankara, Turkey, 14 - 18 September 2015, vol.112, pp.115-122

## Expert Reports

- I. **Etik İncelemesi**  
Kaya Merdan S.  
Fen ve Mühendislik Bilimsel Araştırma Yayın Etiği Komisyonu, pp.3, Ankara, 2020

## Supported Projects

Kaya Merdan S., TUBITAK Project, Türbülanslı Akışların Optimal Kontrolü İçin Zaman Süzgecine Dayalı Verimli Algoritmaların Matematiksel Ve Fiziksel Analizlerinin Ve Etkili Hesaplamalı Yöntemlerinin Araştırılması, 2020 - 2023

Kaya Merdan S., Milli Eğitim Müdürlüğü M. I., Erasmus Project, Artificial Intelligence Education for Youth, 2020 - 2023

KAYA MERDAN S., TUBITAK Project, Manyetik Alan Etkisi Altındaki Çift Yayınimli Doğal Konveksiyon Problemi İçin İkinci Mertebe Zaman Adımlaması Yöntemleri Ailesi, 2019 - 2020

KAYA MERDAN S., Project Supported by Higher Education Institutions, Zaman adımlı metotların doğal konveksiyon problemleri için sayısal incelemesi, 2018 - 2019

KAYA MERDAN S., Project Supported by Higher Education Institutions, BDF2 diskterizasyonlu SUPG sonlu eleman yönteminin sayısal analizi üzerine, 2017 - 2017

Kaya Merdan S., Project Supported by Higher Education Institutions, Grup Ortalamalı Turbulanslı Akış Metodunun Sayısal İncelemesi, 2016 - 2016

KAYA MERDAN S., Project Supported by Higher Education Institutions, Projenin Adı: Grup Ortalamalı Turbulanslı Akış Metodunun Sayısal İncelemesi, 2016 - 2016

KAYA MERDAN S., Project Supported by Higher Education Institutions, Manyeto Hidrodinamik Akış İçin Projeksiyona-Dayalı-Kararlı Metodonun Sayısal İncelemesi., 2012 - 2012

## Activities in Scientific Journals

Communications Faculty of Sciences University of Ankara Series A1 Mathematics and Statistics, Committee Member, 2023 - Continues

## Scientific Refereeing

Diferensiyel denklemler, Scientific / Professional Book Published by Renowned Publishing Houses, July 2022

COMPUTERS & MATHEMATICS WITH APPLICATIONS, SCI Journal, March 2020

NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS, SCI Journal, March 2020

Project Supported by Higher Education Institutions, BAP Research Project, Orta Doğu Teknik Üniversitesi, Turkey, December 2018

COMPUTERS & MATHEMATICS WITH APPLICATIONS, SCI Journal, November 2018

BALIKESİR ÜNİVERSİTESİ FEN BİLİMLERİ ENSTİTÜSÜ DERGİSİ, National Scientific Refreed Journal, August 2018

TUBITAK Project, 1001 - Program for Supporting Scientific and Technological Research Projects, Turkey, July 2018

## Scientific Consultations

TÜBİTAK, Project Consultancy, Middle East Technical University, Faculty of Arts and Sciences, Department of Mathematics, Turkey, 2018 - Continues

## Tasks In Event Organizations

Bozkaya C., Kaya Merdan S., TKMD Lisansüstü Yaz Okulu IV, Science / Art Camp or Summer School Organization, Ankara, Turkey, Haziran 2019

## Metrics

Publication: 64

Citation (WoS): 855

Citation (Scopus): 871

H-Index (WoS): 14

H-Index (Scopus): 15

## **Awards**

Kaya Merdan S., Erođlu F. G., Rebholz L., The Best student award of 2018 International Conference of Applied and Engineering Mathematics, International Association Of Engineers, July 2018

## **Non Academic Experience**

ODTÜ

UNiversity of Pittsburgh

Illinois Institute of Technology

Illinois Institute of Technology

University of Pittsburgh

University of Pittsburgh

Ankara University

Ankara Üniversitesi