

## **IHSAN BERK TULU**

Assistant Professor  
Department of Mining Engineering  
Benjamin M. Statler College of Engineering and  
Mineral Resources, West Virginia University (WVU)  
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### **EDUCATION**

**Ph.D., Mining Engineering** Aug 2009– Aug 2012  
**West Virginia University (WVU), Morgantown, WV**

**M.S., Mining Engineering** Jan 2007 – Aug 2009  
**West Virginia University (WVU), Morgantown, WV**

**B.S., Mining Engineering** Sep 1999 – Jan 2004  
**Middle East Technical University (METU), Ankara, TURKEY**

### **WORK / RESEARCH EXPERIENCE**

**Department of Mining Engineering, WVU, Morgantown, WV** Aug 2017 – present  
**Assistant Professor**

#### **RESEARCH PROJECTS:**

- A Practical Mechanics Based Approach to Pillar Design 07/18-Present  
*Role:* Principal Investigator  
*Funding Organization:* Alpha Foundation
- Analysis of Longwall Mine Layouts 07/18-Present  
*Role:* Principal Investigator  
*Funding Organization:* US DHHS-CDC-NIOSH

#### **TEACHING:**

- MINE261 Engineering CAD
  - FALL2017 SEI (Effectiveness: 4.7, Course: 4.7, Learning: 4.7)
  - FALL2018 SEI (Effectiveness: 5.0, Course: 4.9, Learning: 4.8)
- MINE201 Mine Surveying
  - FALL2017 SEI (Effectiveness: 4.5, Course: 4.4, Learning: 4.5)
  - FALL2018 SEI (Effectiveness: 4.9, Course: 4.9, Learning: 4.4)

**NIOSH Pittsburgh Mining Research Division (PMRD), Pittsburgh, PA** Sep 2012 – Aug 2017  
**Ground Control Branch, Associate Service Fellow**

#### **RESEARCH PROJECTS:**

- Design Procedures for Gateroad Ground Control 09/14-08/17
- Full Extraction Mining 09/15-08/17
- Design of Support Systems to Manage Coal Mine Rib Hazards 09/14-08/17
- Support Design Guidelines for Difficult Ground Conditions 03/13-09/14
- Empirical Guidelines for Longwall Ground Control Design 09/12-09/13

**West Virginia University, Morgantown, WV** Dec 2011-Aug 2012  
**Graduate Research Assistant in Mining Engineering Department and Federal Contractor at Ground Control Branch of PMRD, Pittsburgh, PA**

#### **RESEARCH PROJECTS:**

- Analysis of Thick-Strong Overburden Layers, NIOSH, 02/12-08/12

**West Virginia University, Morgantown, WV** Jun 2011-Dec 2011  
**Engineering Scientist in Mining Engineering Department and Federal Contractor at Ground Control Branch of PMRD, Pittsburgh, PA**

#### **RESEARCH PROJECTS:**

- Modeling Roof Bolt Shear Loading, NIOSH, 06/11-02/11

**West Virginia University, Morgantown, WV** Jan 2007-Jun 2011  
**Graduate Research Assistant in Mining Engineering Department**

**RESEARCH PROJECTS:**

- Calibrating the LaModel Program for Deep Cover Pillar Retreat, NIOSH, 04/08-12/10
- Modeling Rock and Drill Cutter Behavior Under HTHP Conditions, DOE, 01/07-12/10
- 3D Finite Difference (FLAC3D) Analysis of Rectangular and Arched slopes

**University of the Witwatersrand, Johannesburg, SA**  
**Graduate Research and Teaching Assistant / Consultant**

**Dec 2004-Dec 2006**

**PROJECTS:**

- Boundary element (LaModel) and finite element (Phase2) analysis of No5 and No4 seam model of the South Witbank Colliery - G-RO geotechnical services, 03/06- 05/06
- Boundary element (LaModel) analysis of forzando South Coal mine (Total Pyt. Ltd.) - G-RO geotechnical services, 07/06- 11/06
- Development of testing procedures for thin spray-on liners (TSL),

**INMET Mining - Cayeli Bakir Isletmeleri (CBI), Rize, TURKEY**  
**Trainee Engineer in Copper and Zinc Mine**

**Jun 2003-Sep 2003**

**Information about CBI:** CBI is a subsidiary of Inmet Mining of Toronto Canada. The mine produces approximately 1.0 million tons of copper ore annually, using the sublevel retreat mining.

- MineSight software was used extensively in various design applications.
- Quality control of the support systems was performed.

**JOURNAL PUBLICATIONS:****2018**

1. Tulu, I.B., G.S. Esterhuizen, T.M. Klemetti, K.M. Mohamed, D. Gearhart, D.W.H. Su. "Analysis of global and local stress changes in a longwall gateroad." *International Journal of Mining Science and Technology (IJMST)* Volume 28, Issue 1, January 2018, Pages 127-135.
2. Keith, A. Heasley and Tulu, I.B. "Using LaModel to Analyze Coal Bumps". *International Journal of Mining Science and Technology (IJMST)*, Volume 28, Issue 5, September 2018, Pages 729-737
3. Zhang, P., D. Gearhart, M.A. Van Dyke, D. Su, G.S. Esterhuizen, Berk Tulu. "Ground response to high horizontal stresses during longwall retreat and its implications for longwall headgate support". *International Journal of Mining Science and Technology (IJMST)*, In press, corrected proof, Available online 4 December 2018.
4. Zhang, P., Tulu, I. B., Sears, M., Trackemas, J. Geotechnical considerations for concurrent pillar recovery in close-distance multiple seams. *International Journal of Mining Science and Technology (IJMST)*. Volume 28, Issue 1, January 2018, Pages 21-27
5. Esterhuizen G.S., D. Gearhart, I.B. Tulu, T.S. Bajpayee. "Analysis of monitored ground support and rockmass response in a longwall tailgate entry." *International Journal of Mining Science and Technology (IJMST)*. Volume 28, Issue 1, January 2018, Pages 43-51
6. Klemetti, T., I.B. Tulu, M.A. Van Dyke. (in press) " Deep cover bleeder entry performance and support loading: a case study." *International Journal of Mining Science and Technology (IJMST)*. Volume 28, Issue 1, January 2018, Pages 85-93

**2017**

7. Ted M. Klemetti, Morgan M. Sears, Ihsan B. Tulu. "Design Concerns of Room and Pillar Retreat Panels." *International Journal of Mining Science and Technology, Volume 27, Issue 1, January 2017, Pages 29-35.*

**2016**

8. Tulu, I.B., G.S. Esterhuizen, T. Klemetti, M.M. Murphy, J. Sumner and M. Sloan. "A Case Study of Multi-Seam Coal Mine Entry Stability Analysis with Strength Reduction Method." *International Journal of Mining Science and Technology, Volume 26, Issue 2, March 2016, Pages 193-198.*
9. Esterhuizen, G.S. and I.B. Tulu "Analysis of alternatives for using cable-bolts as primary support at two low-seam coal mines." *International Journal of Mining Science and Technology, Volume 26, Issue 1, January 2016, Pages 23-30.*

**CONFERENCE PUBLICATIONS:**

**2018**

1. Nandula, A., Heasley, K.A., Tulu, I.B. "An Area Calculations of the ARBS Support Intensity." *SME 37<sup>th</sup> International Conference on Ground Control in Mining, Morgantown, WV, July, 2018.*
2. Sears, M., Van Dayke, M. Klemetti, T. Su, D., Tulu I.B. "The Effect of Floor Strength and Horizontal Stress Orientation on Floor Heave in a Deep U.S. Longwall Mine. *52<sup>nd</sup> US Rock Mechanics Symposium, Seattle, 2018.*
3. Van Dayke, M., Sears, M., Klemetti, T. Su, D., Tulu I.B., Joe, W. "Geological Evaluation of Floor Heave in a Longwall Mine Under Deep Overburden. *52<sup>nd</sup> US Rock Mechanics Symposium, Seattle, 2018.*

**2017**

4. Tulu, I.B., G.S. Esterhuizen, T.M. Klemetti, K.M. Mohamed, D. Gearhart, D.W.H. Su. "Analysis of global and local stress changes in a longwall gateroad." *36<sup>th</sup> International Conference on Ground Control in Mining, Morgantown, WV, July, 2017.*
5. Tulu, I.B., G.S. Esterhuizen, K.M. Mohamed, T.M. Klemetti. "Verification of a calibrated longwall model with field measurements." *51<sup>st</sup> US Rock Mechanics Symposium, San Francisco, 2017.*
6. Esterhuizen, G.S., I.B. Tulu, T.S. Bajpayee. "Application of brittle failure model to evaluate roof stability in coal mine entries." *51<sup>st</sup> US Rock Mechanics Symposium, San Francisco, 2017.*
7. Esterhuizen G.S., D. Gearhart, I.B. Tulu, T.S. Bajpayee. "Analysis of monitored ground support and rockmass response in a longwall tailgate entry." *36<sup>th</sup> International Conference on Ground Control in Mining, Morgantown, WV, July, 2017.*
8. Klemetti, T., I.B. Tulu, M.A. Van Dyke." Deep cover bleeder entry performance and support loading; a case study." *36<sup>th</sup> International Conference on Ground Control in Mining, Morgantown, WV, July, 2017.*
9. Gearhart, D., G.S. Esterhuizen, I.B. Tulu. "Changes in stress and displacement caused by nearby and adjacent longwall panel retreat." *36<sup>th</sup> International Conference on Ground Control in Mining, Morgantown, WV, July, 2017.*
10. Sears M., Ihsan B. Tulu, Gabriel Esterhuizen. "Overview of Current Longwall Gateroad Support Practices." *Proceedings of The Society for, Mining, Metallurgy and Exploration, Inc. Annual Conference, Denver, Colorado, 2017.*

**2016**

11. Tulu, I.B., G.S. Esterhuizen "Roof Collapse Modeling with FLAC3D", *50<sup>th</sup> US Rock Mechanics Symposium, Houston, 2016.*
12. Esterhuizen, G.S. and I.B. Tulu. "Application of the Strength Reduction Method in Coal Mine Roof Support Design." *3<sup>rd</sup> International Symposium on Mine Safety Science and Engineering, Montreal, Canada, 2016.*
13. K.M. Mohamed, I.B. Tulu and M.M. Murphy. "Numerical Model Calibration for Simulating Coal Ribs". *Proceedings of the 35<sup>th</sup> International Conference on Ground Control in Mining, Morgantown, WV, July, 2016.*
14. Klemetti, T., M. Sears and I.B. Tulu. "Design Concerns of Room and Pillar Retreat Panels." *Proceedings of the 35<sup>th</sup> International Conference on Ground Control in Mining, Morgantown, WV, July, 2016. (Selected to the Best of Ground Control SME 2017)*
15. K.M. Mohamed, I.B. Tulu and M.M. Murphy. "Numerical Model Calibration for Simulating Coal Ribs". *Proceedings of The Society for, Mining, Metallurgy and Exploration, Inc. Annual Conference, Phoenix, Arizona, 2016.*

**2015 and Before**

16. Tulu, I.B., G.S. Esterhuizen, T. Klemetti, M.M. Murphy. J. Sumner and M. Sloan. "A Case Study of Multi-Seam Coal Mine Entry Stability Analysis with Strength Reduction Method." *Proceedings of the 34<sup>th</sup> International Conference on Ground Control in Mining, Morgantown, WV, July, 2015. (Selected to the Best of Ground Control SME 2016)*
17. Esterhuizen, G.S. and I.B. Tulu. "Rapid assessment of roof stability in coal mines based on the outcome of validated numerical models." *49<sup>th</sup> US Rock Mechanics Symposium, San Francisco, 2015.*
18. K.M. Mohamed, I.B. Tulu and T. Klemetti. "Numerical Simulation of deformation and Failure Process of Coal-Mass." *49<sup>th</sup> US Rock Mechanics Symposium, San Francisco, 2015.*
19. Tulu, I.B., T. Klemetti, G.S. Esterhuizen and J. Sumner. "A Case Study of Topography-Related Stress Rotation Effects on Multi-seam Stability." *Proceedings of the 33<sup>rd</sup> International Conference on Ground Control in Mining, Morgantown, WV, July, 2014.*
20. Esterhuizen, G.S., I.B. Tulu and T. Klemetti. "Analysis of Factors Influencing Coal Mine Intersection Stability." *48<sup>th</sup> US Rock Mechanics Symposium, Minnesota, 2014.*
21. Murphy, M.M, G.S. Esterhuizen, and I.B. Tulu. "Lateral Reinforcement of Fully Grouted Roof Bolts in a FLAC3D Simulated Coal Mine Entry." *48<sup>th</sup> US Rock Mechanics Symposium, Minnesota, 2014.*
22. Tulu, I. B., K. A., Heasley, "Investigating the Abutment Loading", *Proceedings of the 31<sup>st</sup> International Conference on Ground Control in Mining, Morgantown, WV, July, 2012.*
23. Tulu, I. B., G.S., Esterhuizen and K. A., Heasley, "Calibration of FLAC3D to Simulate the Shear Resistance of Fully Grouted Rock Bolts", *46<sup>th</sup> US Rock Mechanics Symposium, Chicago, 2012*
24. Tulu, I. B., K. A., Heasley, "Investigating the Mechanics of Pillar Loading Through the Analysis of Insitu Stress Measurements", *45<sup>th</sup> US Rock Mechanics Symposium, San Francisco, 2011*
25. Heasley, K. A., I. B. Tulu, "Calibrating the Input Parameters of LaModel Program", *Proceedings of The Society for, Mining, Metallurgy and Exploration, Inc. Annual Conference, Denver, Colorado, 2011.*

26. Tulu, Ihsan, B., K. A., Heasley, C., Mark. "A Comparison of the Overburden Loading in ARMPS and LaModel", *Coalnews*, Volume: 8, Number: 1, January 2011. ([http://www.coalnews.net/images/pdf/CoalNews\\_0111.pdf](http://www.coalnews.net/images/pdf/CoalNews_0111.pdf))
27. Tulu, Ihsan, B., K. A., Heasley, C., Mark. "A Comparison of the Overburden Loading in ARMPS and LaModel", *Proceedings of the 29<sup>th</sup> International Conference on Ground Control in Mining, Morgantown, WV, July, 2010. (Selected to the Best of Ground Control SME 2011)*
28. Heasley, Keith A., Morgan M. Sears, Ihsan B. Tulu, Christian H. Calderon-Arteaga, Larry W. Jimison II, "Calibrating the LaModel Program for Deep Cover Pillar Retreat Coal Mining," *Proceedings of the 3<sup>rd</sup> International Workshop on Coal Pillar Mechanics and Design, Morgantown WV, July 26, 2010, 47-57.*
29. Tulu, I. B., K. A., Heasley. "Calibration of 3D Cutter-Rock Model with Single Cutter Tests", *43<sup>rd</sup> US Rock Mechanics Symposium, Asheville, 2009.*
30. Tulu, I. B., K. A., Heasley, I., Bilgesu, O., Sunal, "Modeling Rock and Drill Cutter Behavior", *42<sup>nd</sup> US Rock Mechanics Symposium, San Francisco, 2008 .*
31. Sunal, Ozge, H. Ilkin Bilgesu, Keith Heasley, and Ihsan Berk Tulu. "A look into casing deformation due to plastic behavior of formations." In *SPE Eastern Regional/AAPG Eastern Section Joint Meeting*. Society of Petroleum Engineers, 2008.

### **SME BEST OF GROUND CONTROL PRESENTATIONS:**

32. Tulu, Ihsan, B., K. A., Heasley, C., Mark. "A Comparison of the Overburden Loading in ARMPS and LaModel", *Proceedings of The Society for, Mining, Metallurgy and Exploration, Inc. Annual Conference, Denver, Colorado, 2011.*
33. Tulu, I.B., G.S. Esterhuizen, T. Klemetti, M.M. Murphy. J. Sumner and M. Sloan. "A Case Study of Multi-Seam Coal Mine Entry Stability Analysis with Strength Reduction Method." *Proceedings of The Society for, Mining, Metallurgy and Exploration, Inc. Annual Conference, Phoenix, Arizona, 2016.*
34. Klemetti, T., M. Sears and I.B. Tulu. "Design Concerns of Room and Pillar Retreat Panels." *Proceedings of The Society for, Mining, Metallurgy and Exploration, Inc. Annual Conference, Denver, Colorado, 2017.*

### **COMPUTER SKILLS:**

#### **Numerical Models:**

- FLAC, FLAC3D, UDEC
- LaModel
- Phase2, Examine2D, 3D

#### **Engineering Design Programs:**

- NIOSH Mining Software ALPS, ARMPS, AMSS, AHSM, ARBS, STOP, CMRR, ARMPS-HWM.
- AutoCAD / Carlson, Vulcan (3D design software developed by MAPTEK), MineSight (3D design software developed by MINTEC), MicroStation (3D design software developed by Bentley Systems)

#### **Others:**

- C, C++, Visual Basic
- MATLAB
- R (R is a language and environment for statistical computing and graphics)
- Microsoft Office Suit

### **HONORS & AWARDS:**

- "A Case Study of Multi-Seam Coal Mine Entry Stability Analysis with Strength Reduction Method." **Selected by the International Journal of Mining Science and Technology editor to be published in 2016.**
- "Analysis of alternatives for using cable-bolts as primary support at two low-seam coal mines." **Selected by the International Journal of Mining Science and Technology editor to be published in 2016.**
- "Design Concerns of Room and Pillar Retreat Panels." **Selected by the International Journal of Mining Science and Technology editor to be published in 2016.**
- **Invited to the Best of Ground Control Session of Society for Mining, Metallurgy & Exploration Annual conferences: in Denver Colorado 2011, in Phoenix Arizona 2016 and in Denver Colorado in 2017.**
- **Outstanding (Ph.D.) Graduate Student Award**, College of Engineering and Mineral Resources, West Virginia University, April 2011.
- Summary of the paper "A Comparison of the Overburden Loading in ARMPS and LaModel" published in the *Coal News* magazine volume 8 number 1. ([http://www.coalnews.net/images/pdf/CoalNews\\_0111.pdf](http://www.coalnews.net/images/pdf/CoalNews_0111.pdf))
- **Graduate Research Assistantship**, Department of Mining Engineering, West Virginia University, January 2007.

### **PROFESSIONAL MEMBERSHIPS:**

- Technical reviewer for International Journal of Rock Mechanics and Mining Sciences, International Journal of Mining Science and Technology, International Journal of Coal Geology.
- Technical reviewer for 2013, 2016 American Rock Mechanics Association (ARMA) conferences.
- Primary Reviewer for International Conference on Ground Control in Mining since 2013.
- Society for Mining, Metallurgy & Exploration (SME)
- American Rock Mechanics Association (ARMA)
- Pittsburgh Coal Mining Institute of America (PCMIA)
- West Virginia Coal Mining Institute (WVCMII)
- West Virginia Coal Association (WVCOAL)
- Society of Mining Professors (SOMP)