



MONTANA TECH

GEOPHYSICAL ENGINEERING

July 2015

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LETTER FROM THE CHAIR

This year we welcome a new faculty member to the department. Mohamed Khalil arrives in August to fill our EM/electrical methods position. Dr. Khalil has a PhD from the Justus Liebig University of Giessen, Germany, and comes to us most recently from the University of Lisbon, Portugal. He has a broad background in EM and electrical methods including ERT, TDEM, FDEM, VLF, MT and GPR. He has additional background and interest in well logging, hydrochemistry, isotope hydrology and petrophysics. See the faculty section later in this newsletter to find out more about Mohamed.

Deven Vignali and Bill Sill taught for us to fill the teaching void during our EM/electrical faculty search. This coming year we will be fully staff for the first time in several years.

The Geophysical Engineering Department requested and was awarded \$10,000 in one-time-only funds to upgrade the demonstration equipment used in both the algebra and calculus-based physics sequences. The equipment covers a wide range of topics including kinematics, dynamics, optics and electricity and magnetism.

Newmont Mining Corporation supplied a generous donation of \$15,000 to help us establish a fiber-optics laboratory. Fiber-optic sensing technology has advanced to where ground motion can be monitored using fiber-optic cable.

On Friday, September 25, 2015, we will have our annual Industrial Advisory Board (IAB) meeting in Butte, Montana, to coincide with Homecoming weekend. The IAB provides industry input to our program and this is an important part of our assessment process. Please feel free to contact me if you are interested in serving on the IAB.

Montana Tech recently started a major Capital Campaign to raise funds to support important campus goals including a number of endowed professorships. The Geophysical Engineering Department can grow and strengthen by recruiting an outstanding researcher and teacher to fill an endowed chair. If you would like to help us meet our fundraising goals and help support an endowed professorship, then please contact me and we can discuss how you might help.

Marvin Speece, Professor and Chair



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Hugo Pulju Receives Montana Tech Distinguished Alumni Award

Montana Tech recently honored Hugo Pulju with the Distinguished Alumni Award at the university's 115th Commencement Ceremony on Saturday, May 16, 2015. Hugo received a B.S. in Geological Engineering, 1958, and an M.S. in Geological Engineering, 1964.



Hugo Pulju graduated from Menahga High School in Menahga, Minnesota, in 1948. After graduation, he went to Great Falls, Montana, and worked for the Anaconda Co. Smelter until fall when he enrolled at the Montana School of Mines. A year and a half later, after running out of funds, he dropped out of school and spent one and one-half years working until he was able to gain enough funds to continue his education.

In the fall of 1951, he was drafted into the Army and served two years in Munich, Germany, working at a petroleum depot testing petroleum products for use in the armed forces. After his discharge in 1955, Hugo re-entered the School of Mines and completed his studies in geological engineering and graduated with the class of 1958. While in school, he lettered in baseball for four years and spent two years as student manager for athletics.

Hugo began his career in geophysics with Carter Oil Company in Casper, Wyoming, in 1957. After two years with Carter Oil, he resigned and returned to Minnesota where he earned his degree in mathematics at Bemidji State College. He worked as a teacher of math and science at Menahga High School until 1962 when he returned to Butte to work at the School of Mines as a graduate assistant while earning his master's degree in geological engineering.

After graduation, Hugo received a position with Geophysical Services Inc. and started work as a party chief in geophysical processing at their New Orleans, Louisiana, office. After a year in New Orleans, he was transferred to their Houston office. Two years later Hugo was transferred to their West Coast office in Los Angeles, California. He worked as a party chief processing marine geophysical data and subsequently was promoted to supervisor of geophysical processing and manager of computer operations. The West Coast office was closed in 1970 and Hugo was transferred to Houston, Texas, as a manager of geophysical processing. In 1972 he accepted a position as a geophysical processing manager for Digicon, Inc. in their Houston, Texas, office. Shortly thereafter, he was promoted to vice president of North American operations. In 1974, Hugo resigned his position with Digicon, Inc. and moved to Denver, Colorado. As President, CEO and Chairman of the Board, Hugo established Denver Processing Center, Inc. (DPC). DPC engaged in digital processing of geophysical data for the petroleum industry. Between 1974 and 1984, DPC expanded to include offices in Houston, Texas, Anchorage, Alaska, Buenos Aires, Argentina, Lima, Peru, and Bogotá, Columbia, to provide worldwide services. After DPC was involved in a merger, Hugo retired and started work with a partner recording and processing 2,500 line miles of seismic data in the Montana portion of the Williston Basin. He still owns and offers leases of these data as a service to the petroleum industry.

In 2010, Hugo made a generous contribution of 190 miles of valuable seismic reflection data to the Geophysical Engineering Department at Montana Tech. The data covers the rugged area in northwest Montana that borders Glacier National Park. These data are valued at over \$2,000,000.

Hugo currently resides in Denver, CO.



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Faculty News

John Getty: We have had several active months in the Proppant Research Group. Optical Particle Size Analysis (OPSA) has become a hot topic in proppant testing. Horiba, manufacturer of the CamSizer and Technologies North America, Horiba's distributor for this area, provided a \$1,250 donation that was used as scholarships for Alicia Kastelitz and Rachael Wilford. Both of these young women are majoring in Petroleum Engineering. The scholarships were in support of their leading edge application of the OPSA to proppant gradation measurements.



Alicia authored a paper on the advantages of using the OPSA method for determining the size distribution of proppant. She took second place at the SPE's combined Mid-Continent and Rocky Mountain Regional Student Paper Contest held April 25th at Oklahoma State University in Stillwater.

Collin Ireland (Petroleum) is working on a Summer Undergraduate Research Fellowship (SURF) that is focused on establishing a relationship between proppant pack porosity and its resistance to crush. This research fits into my work with the ASTM on establishing testing standards for proppant.



Jim Girard: Jim continues to teach physics and manage the physics labs.

Curtis Link: Curtis retired from the Department in 2013. He is Professor Emeritus in the Geophysical Engineering Department. After part of a year working for Geolex in Helena, he is back at Montana Tech as Director of the Freshman Engineering Program. He continues to direct graduate research in the Department.



Khalid Miah: My first year as a faculty member in the Geophysical Engineering department has been a great experience. I am in the process of setting up a rudimentary Fiber-optic Sensing Lab (FoSLab) with the help of funding from Newmont, Montana Tech School of Mines and Engineering, and the Montana Tech Faculty Development Initiative Program. I will introduce a new undergraduate course in numerical computing (GEOP 491-01) this coming fall semester. In addition, I will be mentoring a geophysics undergraduate student as part of the university's Undergraduate Research Program and I will co-chair an e-poster session in the upcoming SEG (Society of Exploration Geophysicists) Annual Meeting in New Orleans, Louisiana, this fall.



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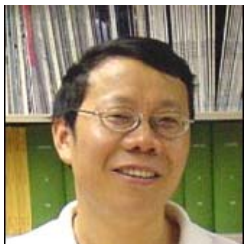
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Marvin Speece: Graduate students Brad Rutherford and Mason Porter continue to process and interpret seismic data from the Flathead area, Montana, that were donated to us by alumnus Hugo Pulju. I expect both students to defend their theses soon. Their reprocessed reflection profiles reveal crustal-scale reflections in the Whitefish and Swan Ranges and adjacent valleys of northwestern Montana. Modern processing techniques such as pre-stack time and depth migration have removed image distortions.



Graduate student Meltem Akam is processing and interpreting a Vertical Seismic Profile (VSP) that was collected in 2007 as part of the ANtartic geological DRILLing (ANDRILL) Program.

I am currently working with Mary MacLaughlin from the Geological Engineering Department at Montana Tech on a National Institute for Occupational Safety and Health funded project to demonstrate the use of fiber optics for enhance mine safety. Fiber optic sensing technology has advanced to where ground motion can be monitored using fiber optic cable. We plan to install fiber optic cable in an underground mine and record seismic events with the cable and compare the results to convention seismometers.



Xiaobing Zhou: I have been at Montana Tech for eleven years. I recently finished my sabbatical leave and resumed teaching in the spring of 2015. I continued to teach Gravity and Magnetic Exploration, Elements of Geophysics, Electricity and Magnetism, Field Geophysics and Electronics for Scientists. This fall I will teach a new course "Remote Sensing" for both upper level undergraduates and graduates. I plan to introduce aerogravity and aeromagnetic along with regular electromagnetic-based techniques such as hyperspectral, thermal, passive microwave, and active radar in the courses. For research, I finished a NASA/Montana Space Grant Consortium project of deriving soil moisture/snow wetness from satellite radar data. Graduate student Adeniyi Adewuyi graduated in December, 2014, with his successful defense of his thesis "Derivation of Soil Moisture and Snow Wetness from the RADARSAT-1 SAR images over a Permafrost Region in Interior Alaska". A manuscript is being prepared from his thesis to be submitted soon. A manuscript on modeling of soil electrical conductivity due to controlled CO₂ release by a previous graduate student Scott Jewell and others was formally accepted by the journal *Geophysics*. I serve as an associate editor for the *Journal of Applied Remote Sensing*, and I was recently invited to be a review panelist for NASA's IceBridge missions to help the program manager select IceBridge instrument proposals to be funded.

Deven Vignali: I am currently a Visiting Professor of the calculus-based physics sequence here at Montana Tech. In 2009, I graduated from Montana Tech with my BS in Mathematical Sciences with a Secondary Education focus. I also received my MS in Geoscience (Geophysical Engineering option) from Montana Tech in 2014. While earning my MS, my thesis involved finite-difference and finite-element modeling of passive seismic data generated in the presence of geothermal resources. I have geophysics-related professional experience in petroleum geology and magnetotelluric surveying. My research interests are passive seismic and geothermal resources. Also, I will be getting married this August!





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Mohamed Khalil: I spent this summer acquiring 3-D time domain electromagnetic data for mineral exploration. I used newly acquired equipment and worked with colleagues at the applied and environmental geophysics team at the University of Lisbon. This was difficult and interesting work, particularly under the sun of Portugal. Currently, I am working on processing and interpretation of these data. In parallel, I am preparing to move to Butte to join the Geophysical Engineering Department at Montana Tech and teach electrical and electromagnetic methods.

Recent Publications

- Adeuyi, A., and X. Zhou, 2014, Derivation of volumetric liquid water content from the RADARSAT-1 SAR images over a permafrost region in interior Alaska: *2014 American Geophysical Union Fall meeting*, Abstract C21C-0384.
- Bellefleur, G., Schetselaar, E., White, D., Miah, K., and Dueck, P., 2014, 3D seismic imaging of the Lalor volcanogenic massive sulphide deposit, Manitoba, Canada: 3D seismic imaging of Lalor deposit: *Geophysical Prospecting*, DOI: 10.1111/1365-2478.12236.
- Bellefleur, G., Schetselaar, E., Miah, K., and White, D., 2014, 3D-3C reflection seismic imaging of the Lalor VMS deposit, Manitoba, Canada: *76th EAGE Conference and Exhibition - Workshop 5, Hard rock seismic imaging*.
- Farzamian, M., Santos, F. M., and Khalil, M. A., 2015, Application of EM38 and ERT methods in estimation of saturated hydraulic conductivity in unsaturated soil: *Journal of Applied Geophysics*, **112**, 175–189. DOI: 10.1016/j.jappgeo.2014.11.016.
- Fernandes, J., Amaral, H., Khalil, M., Ramalho, E., Goncalves, C., Gama, C., Batista, M., Abreu, M., Sapereira, P., Almeida, C., Dill, A., Santos, F., and Condesso, T., 2015, Soil and groundwater contamination of P-NAC, a case study in the old Portuguese company of explosives: *10th Seminar on Groundwater*, Evora.
- Francés, A. P., Ramalho, E. C., Fernandes, J., Groen, M., Hugman, R., Khalil, M. A., De Plaen, J., and Santos, F. M., 2015, Hydrogeophysics contribution to the hydrogeological conceptual model of the Albufeira-Ribeira de Quarteira coastal aquifer (Algarve, Portugal): Accepted in *Hydrogeology Journal*, Manuscript Number: HJ-2014-3445.
- Francés, A. P., Ramalho, E. C., Fernandes, J., Groen, M., de Plaen, J., Hugman, R., Khalil, M. A., Santos, F. A. M., 2014, Hydrogeophysics contribution to the development of hydrogeological conceptual model of coastal aquifers – Albufeira-Ribeira de Quarteira aquifer case study: *Eighth Assembleia Luso Espanhola de Geodesia e Geofísica*, Evora.
- Kellogg, C. H., and X. Zhou, 2014, Impact of the construction of a large dam on riparian vegetation cover at different elevation zones as observed from remotely sensed data: *International Journal of Applied Earth Observation and Geoinformation*, **32**, 19–34.
- Khalil, M. A., Santos, F. M., Farzamian, M., and Kenawy, A., 2015, 2-D Fourier transform analysis of the gravitational field of Northern Sinai Peninsula: *Journal of Applied Geophysics*, <http://dx.doi.org/10.1016/j.jappgeo.2015.01.022>.
- Khalil, M. A., Santos, F. M., 2014, Geophysical evidences for the hydro-tectonic origin of the Sabkha El Sheikh Zwayed Lake and the shallow fresh water supplies, Northern Sinai, Egypt: *Near Surface Geophysics*, DOI: 10.3997/1873-0604.2014036.
- Khalil, M. A., Santos, F. M., and Farzamian, M., 2014, 3D gravity inversion and Euler deconvolution to delineate the hydro-tectonic regime in El-Arish area, northern Sinai Peninsula, *J. Appl. Geophysics*. (2014), <http://dx.doi.org/10.1016/j.jappgeo.2014.01.012>.



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Recent Publications, continued

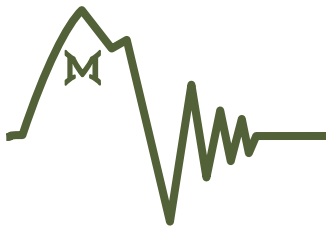
- Khalil, M. A., and Santos, F. A. M., 2014, 3D gravity inversion of Northern Sinai Peninsula, a case study: *Pure and Applied Geophysics*, 171, P.1557-1569. DOI 10.1007/s00024-013-0707-5.
- Knatterud, L., Mosolf, J., Speece, M., and Zhou, X., 2014, Geophysical investigation of Avon Valley, west-central Montana, using gravity and seismic reflection profiling: *2014 Fall Meeting, AGU*, Abstract T43C-4752.
- Mack, A., Speece, M., and Masters, M., 2014, A ground penetrating radar survey at the Fred Burr Creek bison butcher-kill site in Western Montana: *Montana Tech Second Annual Summer Undergraduate Research Fellowship Poster Symposium Program, 2*.
- Porter, M., Speece, M., Rutherford, B., and Constenius, K., 2014, Reprocessing and interpretation of vintage seismic reflection data: evidence for the tectonic history of the Rocky Mountain Trench, northwest Montana: *2014 Fall Meeting, AGU*, Abstract T23A-4640.
- Ramalho, E., Khalil, M., Fernandes, J., Amaral, H., and Santos, F. M., 2015, Geophysical assessment of contamination due to explosives in an abandoned facility towards its hydrogeological characterization: *Environmental Earth Sciences*, DOI 10.1007/s12665-015-4070-y.
- Ramalho, E., Khalil, M., Fernandes, J., Amaral, H., and Santos, F. M., 2014, Contamination in the old SPEL facilities (Seixal): geophysical assessment contribution as an input towards its hydrogeological characterization: *Eighth Assembleia Luso Espanhola de Geodesia e Geofísica*, Evora.
- Rutherford, B. S., Speece, M. A., Stickney, M. C., Mosolf, J. G., 2014, Geophysical evidence for the tectonic development of the Swan Range and adjacent basins, northwestern Montana: *Rocky Mountain (66th Annual) and Cordilleran (110th Annual) Joint Meeting, GSA*, Paper No. 5-10.
- Sharma, B., M. E. Apple, X. Zhou, J. M. Olson, C. Dorshorst, L. M. Dobeck, A. B. Cunningham, and L. Spangler, 2014, Physiological Responses of Dandelion and Orchard Grass Leaves to Experimentally Released Upwelling Soil CO₂, *International Journal of Greenhouse Gas Control*, **24**, 139–148.
- Zhou, X., 2014, A 3D homogeneous locator for magnetic anomalous sources: algorithm development and testing: *2014 American Geophysical Union Fall meeting*, Abstract NS42A-06.

Recent Thesis:

- Adeniyi Adewuyi, M. S., 2014, Geophysical Engineering, *Derivation of Soil Moisture and Snow Wetness from Satellite Radar Images over a Permafrost Region in Interior Alaska*.

2015 Senior Design Project:

- Alsadiq, S., Leone, J., and Valdez, M., 2015, *Testing of Conventional Geophones in an Underground Mine*: Prepared for the National Institute for Occupational Safety and Health (NIOSH), 46 pp.



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Geophysics Field Camp 2015



Photo credit: David Nolt



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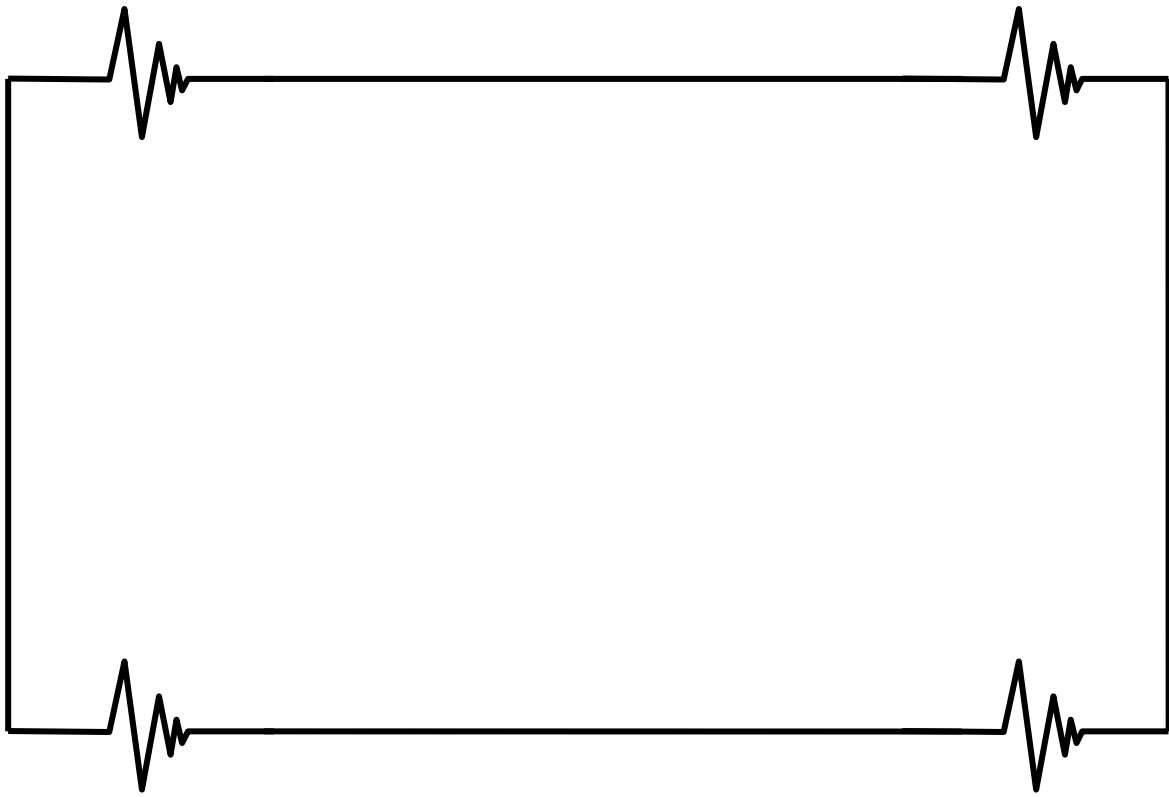
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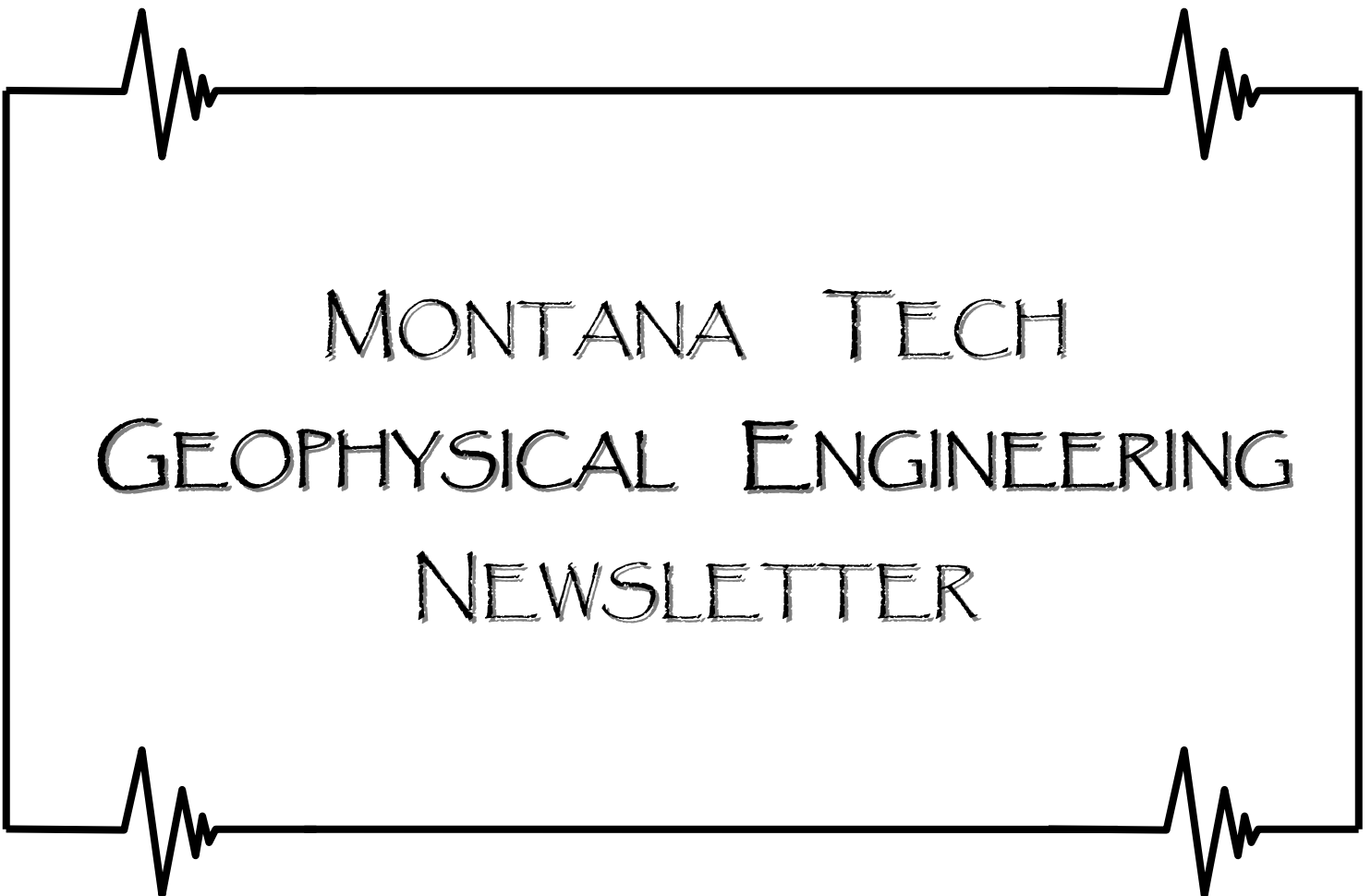
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