

CURRICULUM VITAE

of

Dr NIKOS VAROTSIS

**PROFESSOR of the
Department of Mineral Resources Engineering
THE TECHNICAL UNIVERSITY OF CRETE**

Director of the PVT & Core Analysis Laboratory



**Former Head of the PVT & FLUID ANALYSIS
Research & Development group of SCHLUMBERGER**

- **Former Vice Rector for Finance Planning and Development of the Technical University of Crete, Greece**
- **Former Chairman of the Research Committee of the Technical University of Crete, Greece**
- **Former Chairman of the Mineral Resources Engineering Department of the Technical University of Crete, Greece**

CURRICULUM VITAE

NAME : **NIKOS VAROTSI**

DATE OF BIRTH : 13 March 1953

PLACE OF BIRTH : Corfu, Greece

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MARITAL STATUS Married, with 4 children

Current Positions

- Professor of Reservoir Engineering, School of Mineral Resources Engineering, Technical University of Crete, 1990-
- Director of the PVT & Core Analysis Laboratory, School of Mineral Resources Engineering, Technical University of Crete, 1991-

Studies

- PhD in Petroleum Engineering, Heriot-Watt University, Scotland, 1984

PhD Thesis Title: "Laboratory and Theoretical Investigation of the Near Critical Phase Behaviour of Hydrocarbon-Injection Gas Systems"

- MEng in Petroleum Engineering, Heriot-Watt University, Scotland, 1977
- Diploma in Chemical Engineering, National Technical University, Athens, Greece, 1976

Academic Experience

- 1990- : Professor of Reservoir Engineering at the School of Mineral Resources Engineering of the Technical University of Crete, Greece
- 2013- : Engineering program co-ordinator and Lecturer for the postgraduate MSc program “MSc in Oil & Gas Technology” at KavTech Institute of Technology, Greece

Administrational Experience

- 2005-2010 Vice Rector for Finance Planning and Development of the Technical University of Crete, Greece
- 2005-2010 Chairman of the Research Committee of the Technical University of Crete, Greece
- 1999-2005 Vice-Chairman of the Research Committee of the Technical University of Crete, Greece
- 1999-2003 Chairman of the Mineral Resources Engineering Department of the Technical University of Crete, Greece

Research and Industrial Experience

- 1984-1990 : Head for PVT and Fluid Analysis, Research and Development, of Schlumberger in Paris, France
- 1980-1984 : Head of the Phase Behaviour Research Group at Heriot-Watt University
- 1978-1980 : Production Engineer at the Military Rubber Factory, Athens

Teaching Experience

- 1991- : Teaching since 1991 several Reservoir Engineering undergraduate and postgraduate courses at the Technical University of Crete such as Fundamentals of Reservoir Engineering, Advanced Reservoir Engineering,

Primary and Secondary Production Methods, Improved Oil Recovery Methods, Geothermal Reservoir Engineering, Project Management, etc

- 2013- : Engineering program co-ordinator and Lecturer (Reservoir Engineering) for the postgraduate program MSc in Oil & Gas Technology at KavTech Institute of Technology, Greece
- 1984-2000 : Delivered several reservoir engineering related courses for the professional development of oilfield personnel on behalf of Schlumberger

Professional Activities

- 1990 - : Acting Consultant since 1990 on Phase Behaviour and Fluid Analysis topics for Schumberger Research & Development, Oilphase plc and Schlumberger Oilfield Services
- 2013 - : Consultant, on a contractual basis, for Petroleum Experts (Petex) for the development of Machine Learning Tools, proxy models and Regression models for describing reservoir fluids phase behaviour
- 1990 - : Acting Consultant since 1990 on Reservoir Engineering and Fluid Analysis topics for the North Aegean Petroleum Corporation plc, for Energean and for Kavala Oil and for Geotech
- 2013 Consultant for KAPPA Exploration & Production Software Training and Consulting

OTHER PROFESSIONAL ACTIVITIES

- Taught Petroleum Engineering, Phase Behaviour and Fluid Characterisation related topics in the Schools for Professional Development for Schlumberger's Field Engineers in Paris.
- Delivered series of seminars, lectures and technical presentations in Europe (U.K, France, Norway, Italy, Greece), the Middle East (Egypt, Pakistan, Dubai, Abu-Dhabi, Qatar, North Yemen, the Far East (Indonesia, Malaysia, Brunei) and Africa (Gabon, Gabinda) to petroleum engineers of several oil companies and government officials on Reservoir Fluid Sampling, PVT and Phase Behavior and Fluid Characterization related subjects.

- Delivered, on behalf of Schlumberger, an intensive PVT Training course for Woodside, Australia, November 1999 in Perth, Australia
- Delivered a key-note presentation on Modern Trends in Reservoir Fluid Characterisation to the International Symposium “Enhanced Oil Recovery in Albania” organized by the Directorate General for Energy of the European Commission, Fier Albania, 1997
- Invited Speaker to the 1990 SPE Forum-Advances in the Field of Fluid Flow and Phase Behaviour” to deliver a lecture with subject “EOS Approach in Compositional Simulation”, Austria, 1990
- Invited Speaker to the Middle East Section of the Society of Petroleum Engineers, Dubai, November 30, 1988 where he gave a presentation with subject “ New Developments in Simulating the Phase Behavior of Reservoir Fluids”
- Invited Speaker to the West Africa Section of the Society of Petroleum Engineers, Port Gentil, Gabon, October 2, 1989 where he delivered a talk with subject “Methods for determining the Properties of Reservoir Fluids”
- Invited Speaker to the Far East Section of the Society of Petroleum Engineers, Jakarta, Indonesia, February 2, 1990 where he gave a lecture with subject “ State of the art in PVT Analysis”
- Invited Speaker to the “Fluid Sampling and Analysis” Conference organized by Phillips 66, Hagensund, Norway, September 29-30, 1989
- Invited Speaker to the “Sampling and PVT Meeting” organized by the U.K Section of the Society of Petroleum Engineers, London, April 24, 1991
- Principal Contributor to the Edition of the Well Evaluation Conference Volume, 1991

PATENTS

- **United States Patent No. 7,966,273 B2**, Jun. 21, 2011 με τίτλο «Predicting Formation fluid Property through Downhole fluid Analysis using Artificial Neural Networks” by Peter Hegeman, Chengli Dong, Charles Woodburn, Graham Birkett, Nikos Varotsis, Vassilis Gaganis
- **United States Patent No 4,864,843** “Method and Apparatus for Chromatographic Analysis in Particular of Petroleum Liquids by Paul Guieze and Nikos Varotsis

He also holds 2 European patents.

OTHER SCIENTIFIC AND PROFESSIONAL DISTINCTIONS

Technical Editor of the SPE Reservoir Evaluation & Engineering Journal and of the SPE Journal published by the Society of Petroleum Engineers and of the Journal of Canadian

Petroleum Technology. He edits also manuscripts for several other international scientific journals such as Fluid Phase Equilibria, Fuel, Computers & Geosciences, Journal of Petroleum Science & Engineering, Chemical Engineering Science, journal of Natural Gas Science & Engineering, etc

Selected by the Society of Petroleum Engineers as Moderator for the PetroWiki, the knowledge capture and transfer wiki that has been launched by SPE.

MAJOR UNDERTAKEN RESEARCH AND DEVELOPMENT PROJECTS

1. "MOREOIL , Evaluation of the Miscible Gas Injection In Oil Reservoirs by Monitoring the Asphaltenes Concentration", Funded by: EU
2. "ANAXIMANDER, Exploration and Evaluation of the Eastern Mediterranean Sea Gas hydrates and the Associated Deep Biosphere". Funded by : EU
3. "Experimental study and modeling of GH formation conditions and migration mechanisms in marine sediments and the associated release of the enclathrated gas in marine environment" Funded by: European Social Fund & National Resources EPEAEK II _ PYTHAGORAS.II.
4. "Hydrate Autoclave Coring Equipment System" Funded by: EU, Sustainable Marine Ecosystems MAST3 (EVK3-2000-00549).
5. "Study of the influence of mineralogy and overburden pressure on the phase behavior and formation kinetics of structure II gas hydrates contained in marine sediments." Funded by: EU Research Access to the European infrastructure for energy reserve optimization, EIERO.
6. Development of a set of ANN models to predict the volumetric ratios and the physical properties of the phases flowing through the Vx multiphase flowmeter. Funded by Schlumberger
7. Development of a set of ANN models to predict rapidly and accurately the equilibrium ratios (k-values) during a compositional reservoir simulation. Funded by KAPPA
8. Development of an ANN model to predict the PVT properties of the MDT/OFA downhole samples. Funded by Schlumberger
9. Development of a fully automated data processing system for gas chromatographs based on machine learning methods. Funded by Schlumberger
10. Development of a method to estimate the shrinkage factor range for recovered reservoir fluid samples. Funded by Schlumberger
11. Experimental measurements and testing of core plugs recovered by the Epsilon-1 well. Funded by Energean.
12. SARA Analysis of solid deposits and crude oil from the Prinos field well PA-35. Funded by Energean
13. "Increase of the domestic capacity recycling used mineral oils" Funded by: General Secretary of Research and Technology
14. "Feasibility study for the determination of the mud filtrate contamination of reservoir fluid samples" Funded by: OILPHASE

15. "Development and pilot application of a completed system for the optimization of lubricants production in the refinery of MOTOR OIL Hellas" Funded by: General Secretary of Research and Technology
16. "Experimental study of the fluid properties of the exploratory well Epsilon-1", Funded by: KAVALA OIL
17. "Physical bioremediation of organic pollutants in the subsoil and in water reservoirs" Funded by the General Secretary of Research and Technology
18. "Determination of reservoir wettability. Study of surface effects in oil-water-rock systems and of their effect in oil production". Funded by: Research Committee , Technical University of Crete
19. "Geochemical study of the oil produced in exploratory well PN-2 in North Prinos reservoir". Funded by: Wintershall AG, Kassel
20. "Experimental study of the rock properties of the exploratory well PN-2 in North Prinos reservoir", Funded by: North Aegean Petroleum Corporation (NAPC)
21. "Experimental study of the fluid properties of the exploratory well PN-2 in North Prinos reservoir", Funded by: North Aegean Petroleum Corporation (NAPC)
22. "Experimental and theoretical study of the behaviour of gas condensates PVT mixtures fluid properties in the North Sea", Funded by: Delft University
23. "Evaluation of the fluid of the production well PN-2 in North Prinos reservoir", Funded by: North Aegean Petroleum Corporation (NAPC)
24. "Experimental study of asphaltenes composition and development conditions for the oil produced in North Prinos reservoir", Funded by: North Aegean Petroleum Corporation (NAPC)
25. "Development of a novel process for seawater desalination and condensation of water solutions and waste water effluents by using GH".
Funded by: European Social Fund & National Resources EPEAEK II _ ARCHIMIDIS II.
26. Evaluation of all the PVT reports issued for the Prinos Reservoir. Funded by North Aegean Petroleum Corporation (NAPC)

SELECTED PUBLISHED PAPERS IN PEER REVIEWED JOURNALS /CONFERENCES

- *Marinakis D, Varotsis N.*, "Gas hydrate dissociation affecting the permeability and consolidation behavior of deep sea host sediment", accepted for publication, Journal of Natural Gas Science & Engineering, 2015
- *Gaganis V., Varotsis N.*, "Rapid multiphase stability calculations in process simulation" presented at the 27th European symposium on Applied Thermodynamics, ESAT 2014, Eindhoven, The Netherlands, 6-9 July 2014
- *Gaganis V., Varotsis N.*, "An integrated approach for rapid phase behavior calculations in compositional modelling", accepted for publication, Journal of Petroleum Science & Engineering, 118 (2014) 74–87
- *Marinakis D, Varotsis N.* : "Solubility measurements of methane + ethane + propane mixtures in aqueous phase with gas hydrates at vapor unsaturated conditions, The Journal of Chemical Thermodynamics, 65 (2013) 100-105

- *Gaganis V., Varotsis N.* : An improved BIP matrix decomposition method for reduced flash calculations, *Fluid Phase Equilibria*, 340 (2013) 63-76
- *Gaganis V., Marinakis D., Varotsis N.* “ A general framework of model functions for fast and robust solution of Rachford-Rice type of equations”, *Fluid Phase Equilibria*, 322-323 (2012) 9-18
- *Gaganis V., Varotsis N.* “Machine learning methods to speed up compositional reservoir simulation”, SPE 154505, Proceedings of EAGE/SPE Annual Conference & Exhibition, Copenhagen, Denmark, 4-7 June 2012
- *Gaganis V., Varotsis N.* “A new transformation for the rapid solution of the Rachford-Rice equation in phase split calculations”, SPE 150932-PP, Proceedings of the North Africa Technical Conference and Exhibition held in Cairo, Egypt, 20–22 February 2012.
- *Gaganis V., Varotsis N.* “Non-iterative phase stability calculations for process simulation using discriminating functions”, *Fluid Phase Equilibria*, 314(2012), p.69-77
- *Hegeman Peter, Dong Chengli, Varotsis Nikos, Gaganis Vassilis,* “Application of Artificial Neural Networks to Downhole Fluid Analysis”, SPE Reservoir Evaluation & Engineering, February 2009, pp 8-13
- *Gaganis V., Varotsis N.,* “The risk of non physically sound tuned cubic Equation of State models : Critical appraisal and remedies”, 23rd European Symposium on Applied Thermodynamics, May 29th-June 1st, 2008, Cannes, France
- *Marinakis D., Varotsis N., Perissoratis C.* “Key sediment properties affected by the presence of gas hydrates in the “Anaximander” deep sea mud volcanoes.”, 9th International Conference on Gas in Marine Sediments, Bremen, Germany, Sep. 15-19, 2008.
- *Varotsis N., Marinakis D., Karantzi K., Manoutsoglu E., E.Christidis G., Perdicatsis V., Kotsakis G., Perissoratis C., Ioakim Ch.* “Sedimentary and sediment stability studies on the Mud Volcanoes (MVs) of the Anaximander Mountains, Eastern Mediterranean.” 3rd Annual meeting of Hotspot Ecosystem Research on the Margins of European Seas (HERMES), Carvoeiro, Portugal, Mar.31– Apr.4, 2008.
- *Marinakis D., Varotsis N., Perissoratis C.* “Key sediment properties affected by the presence of gas hydrates in the “Anaximander” deep sea mud volcanoes.”, 9th International Conference on Gas in Marine Sediments, Bremen, Germany, Sep. 15-19, 2008.
- *Varotsis N., Marinakis D., Karantzi K., Manoutsoglu E., E.Christidis G., Perdicatsis V., Kotsakis G., Perissoratis C., Ioakim Ch.* “Sedimentary and sediment stability studies on the Mud Volcanoes (MVs) of the Anaximander Mountains, Eastern Mediterranean.” 3rd Annual meeting of Hotspot Ecosystem Research on the Margins of European Seas (HERMES), Carvoeiro, Portugal, Mar.31– Apr.4, 2008
- *Marinakis D., Varotsis N.,* “Dissociation of multi-component gas hydrates in clays and their impact on the mechanical properties of the host sediment”, 3rd International Conference on Submarine mass movements and their consequences, October 2007, Santorini, Greece.
- *Marinakis D., Varotsis N., Lazaridis M.,* “Effect of gas hydrate stability on climatic change. The case of “Anaximander” mud volcanoes.”, 10th International Conference

on environmental science and technology, Proceedings pp.A-924 up to A931, September 2007, Kos Island, Greece.

- *Marinakis D., Varotsis N.*, "Natural gas hydrates in deep sea sediments: The effect of the host formation on pore pressure and on hydrate characteristics." *Geophysical Research Abstracts, Vol. 9, 10268, 2007.*
- *Marinakis D., Varotsis N.*, "Hydrates formed from dissolved natural gas in deep marine sediments", 5th International Workshop on Methane Hydrate Research & Development, October 2006, Edinburgh, UK.
- *Gaganis V., Varotsis N., Birkett Gr.*, "Sensitivity controlled Neural Networks for the prediction of PVT Properties exhibit Equation of State like behavior", Proceedings of the 22nd European Symposium on Applied Thermodynamics 28 June-1 July 2006, Elsinore, Denmark
- *Marinakis D., Varotsis N., Kostakis G., Christidis G, et. al.* "Gas hydrate research overview in Greece", 5th International Workshop on Methane Hydrate Research & Development, October 2006, Edinburgh, UK.
- *Marinakis D., Varotsis N., Kostakis G., Christidis G*, "How much gas hydrates can sediment host? Characteristics affecting sediment's store capacity", 2nd International Conference in Mineral Resources Management and Environmental Geotechnology, September 2006, Chania, Greece.
- *Marinakis D., Varotsis N., Pasadakis, N., Yang J. & Tohidi, B.* "Thermodynamic study of undersaturated hydrates formed from a gas mixture in marine sediments", VIII International Conference on gas in marine sediments, September 2005, Vigo, Spain. *Conference Abstracts p.4011.*
- *V. Gaganis, N. Varotsis, J. Nighswander, G. Birkett* "Monitoring PVT Properties Derivatives ensures physically sound tuned EOS behaviour over the entire operating conditions range", SPE 94211, Proceedings of the 14th Europec Biennial Conference, Madrid, Spain, 13-16 June 2005
- *J. Yang, M. Llamedo, D. Marinakis, B. Tohidi, N. Varotsis* "Successful Applications of a versatile ultrasonic system for gas hydrates in unconsolidated sediments", Proceedings of the 5th International Conference on Gas Hydrates, Vol 1: Kinetics and Transport Phenomena, June 13-16, 2005, Trondheim, Norway, ISBN 82-519-2065-5
- *S. Sfakiotakis, N. Pasadakis, N. Varotsis* "Qualitative and Quantitative Study of Asphaltene Precipitation during a Gas Injection Project", Proceedings of the 13th European Symposium on Improved Oil Recovery, Budapest, Hungary 25-27 April, 2005
- *A.K Stubos, T. Ayrdal, H.P. Hjermstandt, J.A. Stensen, N. Varotsis, P. Adler, J. Muller, O.P. Bjorlykke, S. Puskas* "MOREOIL : Evaluation of Miscible Gas Injection in Oil Reservoirs by Monitoring the Asphaltenes Concentration", Proceedings of the 13th European Symposium on Improved Oil Recovery, Budapest, Hungary 25-27 April, 2005
- *S. Sfakiotakis, Chr. Brouzos, N. Varotsis:* " Mathematical model based on equations of state for predicting asphaltenes deposition in oil reservoirs", Proceedings of the 5th Panhellenic Chemical Engineering Conference, Salonica, 29-31 May 2005, pp. 1121-1124

- *Marinakis, D., Varotsis, N., Yang, J., Tohidi*, “The effect on the stability of the deep sea sediment, caused by the dissociation of the contained gas hydrate: The case of “Anaximander” mud volcano seabed.” 32nd International Geological Congress, August 2004, Firenze, Italy. Conf. Proceedings Part 2, 282-18, p. 1250
- *J. Yang, D. Marinakis, B. Tohidi, N. Varotsis*, “Sediment Geomechanical Response to Hydrate Dissociation by Depressurisation: An Experimental Study”, Geophysical Research Abstracts, Vol.6, 07022,2004, European Geosciences Union
- *D. Marinakis, N. Varotsis, Y. Jinhai, B. Tohidi* “The effect on the stability of the deep sea sediment caused by the dissociation of the contained gas hydrate : The case of the Anaximander mud volcano sea bed”, Presented at the 32nd International Geological Congress, Florence, Italy, August 20-28th, 2004
- *Perissoratis, Ioakim, Zacharaki, Lykousis, Sakellariou, Kormas, Woodside, Amann, Maggioli, Daehlmann, De Lange, Casas, Gemma, Meyn, Varotsis, Marinakis* “Exploration and Evaluation of the Eastern Mediterranean Gas hydrates and the Associated Deep Biosphere”, EUROCEAN 2004, Galway, Ireland, May 10-13th, 2004, Conference Abstracts. p. 139-140
- *D. Marinakis, N. Varotsis, J. Yang, B. Tohidi, C. Perissoratis* “Gas Hydrates in the Eastern Mediterranean seabed : energy potential and technological challenge”, Proceedings of the Advances in Mineral Resources Management and Environmental Geotechnology Conference, Chania, June 2004
- *S. Smuk, P. Ross, J. Nighswander, N. Varotsis* “ Quantification of oil based mud filtrate in contaminated reservoir fluid samples”, Proceedings of the 5th International Conference on Petroleum Phase Behaviour & Fouling, Banff, Alberta, Canada, June 13-17, 2004
- *V. Gaganis, N. Pasadakis, P. Smaragdis, N. Varotsis* : “Deconvolution of overlapping HPLC peaks using Independent Component Analysis (ICA)”, Advances in Chromatography and Electrophoresis-Conferentia Chemometrica, Budapest, 27-29 Oct. 2003 p. 21.
- *S. Sfakiotakis, N. Pasadakis, N. Varotsis*: “ Experimental study of the thermodynamic behaviour of asphaltenes in oil reservoir samples at elevated pressures” Proceedings of the 4th Panhellenic Chemical Engineering Conference, Patras, 29-31 May 2003, pp. 517-520
- *N. Varotsis, V. Gaganis, J. Nighswander* “Quality Assurance Tool for PVT Simulator Predictions”, SPE Reservoir Evaluation and Engineering Journal, December 2002, pp 499-506
- *N. Varotsis, V. Gaganis, J. Nighswander* “An innovative ANN based thermodynamic petroleum fluids properties model providing quality assurance predictions” 19th European Seminar on Applied Thermodynamics, Santorini, Greece, September 2002
- *N. Varotsis, V. Gaganis, J. Nighswander* : “Quality assurance tool for PVT simulator predictions” SPE 68235, SPE Middle East Oil Show, Bahrain, 17-20 March 2001

- *T. J. Broad, N. Varotsis, N. Pasadakis* : “the compositional characterisation of gas condensate fluids-A review featuring the impact of the analysis data quality on the accuracy of equation of state based PVT predictions”. SPE Middle East Oil Show, Bahrain, 17-20 March 2001
- *N. Pasadakis, C. Yiokari, N. Varotsis, C. Vayenas* : “Characterization of hydrotreating catalysts using the principal components analysis”, *Applied Catalysis A: General* 207 (2001), 333-341
- *N. Pasadakis, N. Varotsis, N. Kalithrakas* : “The influence of pressure on the asphaltenes content and composition in oils”, *Petroleum Science and Technology*, 19(9&10), 1219-1227 (2001)
- *N. Pasadakis, N. Varotsis, X. Fotinopoulos, P. Kotsokolos* “Lube oil properties prediction by using chemometrics”, *Proceedings of the 3rd Panhellenic Chemical Engineering Conference, Athens*, pp. 217-220
- *N. Pasadakis, V. Gaganis, N. Varotsis* : “Accurate determination of aromatic groups in heavy petroleum fractions using HPLC-UV-DAD”, *Fuel* 80(2001), 147-153
- *M. Kourgiantakis, N. Pasadakis, N. Varotsis*: “Evaluation of the soil pollution by polycyclic aromatic hydrocarbons” *Proceedings of the 3rd Panhellenic Chemical Engineering Conference, Athens, 2001*, pp. 989-992
- *N. Pasadakis, N. Varotsis*. “A novel approach for the quantitation of the hydrocarbon groups in heavy petroleum fractions using HPLC-RI analysis”, *Energy and Fuels*, 14-6(2000), 1184-1187
- *V. Tomos, K. Anyfantaki, N. Pasadakis, N. Varotsis* “Determination of polycyclic aromatic hydrocarbons in oil contaminated soil”, *Proceedings of the 5th International Conference on Environmental Pollution, August 28th-September 1, 2000, Salonica, Greece*
- *N. Pasadakis, N. Varotsis*: “Optimization of the HPLC separation of aromatic groups in petroleum fractions” *Fuel* (79), 2000 1455-1459.
- **Varotsis, N.**, *Gaganis, V, Nighswander, J., Guieze, P.*, “ Novel Non-Iterative Method for Predicting the PVT Behavior of Reservoir Fluids”, SPE 56745, presented at the 1999 SPE Annual Technical Conference, Oct 3-6, 1999, Houston, USA
- *N. Pasadakis, V. Gaganis, N. Varotsis* : “An improved method for the separation of aromatic groups in heavy petroleum fractions by HPLC analysis”, *Proceedings of the International Conference on Instrumental Methods of Analysis-Modern Trends and Applications, Chalkidiki, Greece, 1999*, p.472-476
- *N. Pasadakis, E. Chamilaki, N. Varotsis* “Rapid and accurate determination of the volumetric cuts of Commingled Reservoirs and Pipelines”, *Oil & Gas Journal*, January 3, 1999, pp 46-47
- *N. Pasadakis, V. Gaganis, N. Varotsis*: “An improved method for the separation of aromatic groups in heavy petroleum fractions by HPLC analysis”, *Proceedings of the International Conference on “Instrumental Methods of Analysis-Modern Trends and Applications” Chalkidiki, Greece, 1999*, pp.472-476

- *Chr. Triantos, N. Pasadakis, N. Varotsis, Chr. Fotinopoulos, P. Kotsokolos* “ Octane number prediction of gasoil samples using FTIR spectroscopy and Artificial Neural Networks” Proceedings of the 2nd Panhellenic Chemical Engineering Conference, Salonica, May 1999, pp.645-648
- *Ph. Giannoulis, N. Pasadakis, N. Varotsis, Chr. Fotinopoulos, P. Kotsokolos* “Comparative evaluation of different types of crude oils for the production of base lube oils”, Proceedings of the 2nd Panhellenic Chemical Engineering Conference, Salonica, May 1999, pp.649-652
- **N. Varotsis, N. Pasadakis, V. Gaganis**: “A Novel Approach for the Characterization of Aromatics in Petroleum Fractions Using HPLC-UV-DAD and Evolving Factor Analysis”, *Fuel*, 3032, vol 77, pp 1495-1502, (1998)
- **N. Varotsis, N. Pasadakis**: “Determination of Commingled Crude Oil Streams by HPLC with UV and IR detection”, *Journal of Liquid Chromatography and Related Technologies*, 21(5),657-667(1998).
- **N. Varotsis, N. Pasadakis** : “Determination of Chemical Composition of spent lube oils during the process of catalytic hydrogenation” Proceedings of the 1st National Chemical Engineering Congress, Patras, Greece, 29-31 May 1997, pp.503-508
- **N. Varotsis, N. Pasadakis**: “Quantitative determination of aromatic component groups in lubricant oils using HPLC-SEC and UV-Diode Array Detection”, *Journal of Industrial and Engineering Chemistry Research*, 36, 3915-3919 (1997).
- **N. Varotsis, N. Pasadakis** : “Quantitative determination of aromatic component groups in lubricant oils using HPLC-SEC and UV-Diode Array Detection”, *Journal of Industrial and Engineering Chemistry Research*, American Chemical Society, 36, pp.3915-3919 (1997)
- **N. Varotsis, N. Pasadakis** : “An Analytical Method for Rapid Monitoring of the Degree of Hydrogenation of Recycled Lubricating Motor Oils”, 1997, *Journal of Industrial and Engineering Chemistry Research*, 36, 9, 3915-3919
- **N. Varotsis** : “ Prediction of Gas Phase Volumetric Variations in Diphasic Reservoir Oils”, *Journal of Canadian Petroleum Technology*, Sep. 1997, Vol. 36, 8, pp. 56-60.
- **N. Varotsis, N. Pasadakis** : “Rapid quantitative determination of aromatic groups in lubricant oils using Gel Permeation Chromatography, *Ind. Eng. Chem, Res.* 1997, 36, 5516-5519
- **N. Varotsis, N. Pasadakis** : “Determination of the compositional changes that lube oils undergo during catalytic hydrogenation” Proceedings of the 1st National Chemical Engineering Congress, Patras, Greece, 29-31 May, pp.503-508
- *D. Avlonitis, N. Varotsis* : “Modelling Gas Hydrate Thermodynamic Behaviour: Theoretical Basis and Computational Methods”, *Fluid Phase Equilibria*, 123 (1996) 107-130

- **N. Varotsis, P. Guieze:**“ Reservoir Fluid Characterisation using Gas Chromatography-Mass Spectrometry”, Journal of Petroleum Science and Engineering, 15 (1996) 81-89
- **S. Zervas, N. Varotsis :** “ Rapid Minimum Miscibility Pressure Prediction Condensing Gas Drive Processes” Proceedings of the 2nd National Congress on Computational Mechanics, Chania, Greece, 26-28 June 1996, pp.290-299
- **N. Varotsis, N. Pasadakis :** “ Calibration Prerequisite for accurate PVT Measurements”, Oil & Gas Journal, Jan 29, 1996, 93-96
- **N. Varotsis, N. Pasadakis :** “ An Integrated Method for the Gas Chromatographic Analysis of Natural Gases and Liquid Petroleum Mixtures”, Chimika Chronika, New Series, 25, 287-300 (1995)
- **N. Varotsis** "Phase Behaviour Models to be used for the Simulation of Petroleum Reservoirs. Proceedings of the 1st National Congress on Computational Mechanics, Athens 3-4 September 1992 pp.971-979
- **N. Varotsis, P. Guieze** "Onsite Reservoir Fluid Properties Evaluation", Journal of Petroleum Technology (JPT) of the American Society of Petroleum Engineers (SPE), August 1990
- **N. Varotsis** "A Robust Calculation Method for Rapid Phase Behaviour Calculations", Reservoir Engineering Journal of the American Society of Petroleum Engineers (SPE), May 1989, p.237-243
- **H. Freyss, N. Varotsis, P. Guieze** "PVT Analysis for Petroleum Reservoirs"
- Technical Review, January 1989, p.4-15
- **N. Varotsis** “On-Site Fluid Characterisation”, presented at the 8th Annual Wireline, Seismic & Testing Interpretation Symposium, Ridgefield, Connecticut, October 2-5, 1988
- **N. Varotsis, P. Guieze** “ A Robust Phase Behaviour Predictor for Onsite Reservoir Fluid Properties Evaluation” Proceedings of the 7th Annual Wireline, Seismic & Testing Interpretation Symposium, Ridgefield, Connecticut, June 24-26, 1987
- **N. Varotsis, P. Guieze** " Microdistillation : A method that combines Gas and Liquid Chromatography for the Characterisation of Petroleum Liquids", Journal of Chromatography, 403, 1987, σελ. 159-170
- **N. Varotsis, G. Stewart, A. Todd, M. Clancy** "Phase Behaviour of systems comprising North Sea Oils and Injection gases", SPE Journal of Petroleum Technology (JPT), November 1986, pp. 1221-1233
- **P. Guieze, J.M. Williams, N. Varotsis** " Equations determine PVT curves", Oil and Gas Journal, October 1985, 83, No 42.
- **M. Clancy, G. Stewart, A. Thompson, A.C. Todd, N. Varotsis** “Optimised Compositional Models for Simulation of EOR Processes”, Proceedings of the 3rd European Meeting on Improved Oil Recovery, Rome, Italy, 16-18 April 1985

- *M. Clancy, W. Laidlaw, G. Stewart, A.C. Todd, N. Varotsis* "Hydrocarbon Mixtures at High Pressures-Data and Methods available", Proceedings of " Estimating the Properties of the Offshore Gas Technology Seminar organised by the Institution of Chemical Engineers, London, November 1983 pp. 7-1,7-28
- *N. Varotsis, A.C. Todd, G. Stewart* "An Iterative Method for Phase Equilibria Calculations with particular application to Multicomponent Miscible Systems", Proceedings of the 1st European Conference of Enhanced Oil Recovery, Bornemouth, UK, September 1981, pp.313-328
- *N. Varotsis, A.C. Todd* "Phase Equilibria Predictions for Multicomponent Hydrocarbon systems for Application in CO₂ Enhanced Oil Recovery Schemes", Proceedings of the 8th Annual Research Meeting of the Institution of Chemical Engineers, Edinburgh, UK, 27-28 April 1981, pp.95-100

Main Professional and Research Tasks undertaken for the period 1980-today

1980-1984

The main task during that period was to create and guide a research group sponsored jointly by the British Department of Energy and the oil industry, to study the phase behaviour and the physical chemical processes and the engineering of miscible gas (CO₂, N₂, hydrocarbon gas) flooding and the characterisation of the resulting phases at high pressures and temperatures.

The goal of the scientific team was to support the research programmes of the British Department of Energy with thermodynamic equilibrium and fluid characterization laboratory data of the injected gas and hydrocarbon phases and to develop theoretical models. In 1984, the team had a total research budget of over 1,000,000 pounds sterling financed by the industry and by the British government.

1984-1990

In charge of the PVT and Fluid Analysis Research and Development group of SCHLUMBERGER in Paris. The group specialises in hydrocarbon phase separation, analytical chemistry, chromatographic (GC, GC-MS and HPLC) topics as well in the theoretical study of the thermodynamic equilibrium of gas and liquid mixtures. Some of its tasks were :

- (a) the design and development of new tools and services to be used onsite during oil and gas well testing to characterise the phase behaviour and the properties of the formation fluids
- (b) the invention and development of novel laboratory methods for the measurement of the physico-chemical properties of hydrocarbon mixtures in order to create new services.
- (c) the development of characterisation methods using Mass spectrometry and optical detectors for the detailed analysis of complex hydrocarbon mixtures.

For the above work one U.S Patent (US Patent No 4864843) and one European Patent (87401151.8) have been filed. The former covers a unique method for the chromatographic analysis of petroleum liquids.

1990-

In charge of setting-up and running a new PVT & Core Analysis Laboratory at the Technical University of Crete. This Laboratory is unique in Greece and is performing research projects and contractual work with the oil industry among others in the following areas :

- PVT and phase behaviour laboratory measurements of reservoir fluids at bottom hole and at surface conditions
- Compositional analysis and fluid characterization of oil and natural gas phases
- Physical Properties measurements of Petroleum and its Fractions
- Thermodynamic behaviour and dissociation kinetics of gas hydrates in mixtures or contained in sediments
- Asphaltenes deposition studies
- PVT simulation modeling based on EOS
- Development of Machine Learning Tools (ANN, SVC, etc) for the fast and accurate prediction of fluids physical properties
- Catalytic Processing of hydrocarbon mixtures
- Determination of Oil Pollutants in the environment
- Routine and specialized reservoir core analysis

Several research projects as well as studies of industrial interest have been conducted including the detailed characterisation of the reservoir fluid and of the rock which comprise the Prinos field in Northern Greece. The laboratory is equipped, among others, with Gas Chromatographs (FID, TCD, NPD detectors), Gas Chromatograph-Mass Spectrometer, FT-IR, HPLC (Photo Diode Array, Refractive Index detectors), Gel Permeation Chromatograph, PVT visual cells (1000 bar, 250oC), Relative Permeability apparatus, etc