Identification of the three-dimensional legal aspects of Greek real estate legislation in the context of 3D LAS

Dionysia-Georgia PERPERIDOU, Dimitrios VAZOURAS, Ioanna KLOUKINA, Dimitrios PAPASTAMOU, Greece

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SUMMARY

The Greek Civil Code, which was introduced in 1946, was a major breakthrough in the Greek legal system, particularly its third book, which deals with Greek property law. Its rapporteur, Professor Georgios Balis of the Athens School of Law, considered that this new legal framework, on the one hand, was a continuation of the long-standing Byzantine-Roman law (in force since the 14th century) and, on the other hand, by limiting the rights to four - ownership, easement, pledge and lease - could effectively contribute to land management and stop the fragmentation of land and property rights. Greek property law itself is based on 3D descriptions of rights and their restrictions, which in many cases have not yet been rendered at a technical and/or spatial level, especially at the legal level. As a result, the 3D legal description of property rights and restrictions is not followed by the equivalent 3D technical and spatial description. Herein, is presented the 3D legal descriptions of property rights at the spatial level and within the basic framework of 3D LAS. The 3D interrelationships of Greek property law with other aspects of the Greek legal system related to real estate (rights, use, development, restrictions, rules) are analysed in detail. Special emphasis is given to the analysis of the interactions of Greek property law with urban planning legislation and the procedures for the recognition and identification of arbitrary constructions and the issuance of building permits, which have recently been revised at the 3D level. This approach can be the starting point for the design and implementation of 3D LAS in Greece, based on the public data base of the Hellenic Cadastre, as provided for in its founding law.

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1. INTRODUCTION

The scope of land administration (LA) and land administration systems is to ensure sustainable development, especially under the demands of society for equal opportunities in terms of secure housing, access to education, work opportunities, food security, etc. (UN-FIG 1999; Dale and McLaughlin 2000; Steudler, Rajabifard, and Williamson 2004; Williamson et al. 2010; Lemmen, Van Oosterom, and Bennett 2015). At the same time, serious challenges or technological developments at the global level, such as global urbanisation (United Nations, Department of Economic and Social Affairs, Population Division 2019), climate change and reduction of energy consumption (Sussman 2008; United Nations 2020), urban air mobility affecting urban or spatial planning trends (Perperidou and Kirgiafinis 2023), integrated management of blue-green infrastructures (Ghofrani, Sposito, and Faggian 2017; O'Donnell et al. 2021) or underground space (Cui, Broere, and Lin 2021; Hámor-Vidó, Hámor, and Czirok 2021), are major challenges for LA and LAS. On the other hand, legal-technical descriptions on property rights and properties and restrictions or regulations on the use of properties, especially in the light of global challenges and technological developments, pose great challenges to LA and LAS, and especially when discussing their three-dimensional aspects. The development of 3D data types can also support and enhance the development of 3D cadastral systems (Germann, Lüthy, and van Oosterom 2018; van Oosterom et al. 2018; Kalogianni et al. 2020; Paasch and Paulsson 2023).

However, as there are different legal systems on the legal-technical definition of properties and relevant legislation on restrictions and regulations on the use of properties, the standardisation or unification of 3D properties, 3D RRR and relevant regulations and legislation is a major challenge (Paasch and Paulsson 2021; 2023). The 3D representation or real legal properties can also be challenging (Kitsakis et al. 2016), while the determination of boundaries in different jurisdictions leads to inhomogeneous spatial/cadastral data correlated with descriptive/legal definitions (Çağdaş et al. 2023). as land administration legislation varies from country to country, making it difficult to have a unified LAS at the global level, identifying the three-dimensional legal aspects of a country's real estate legislation can facilitate the establishment and implementation of country-based 3D LAS, especially in the case of countries that are currently developing their cadastral system but have a strong legal history and background on PL and property rights. Herein, is presented the 3D legal descriptions of property rights at the spatial level and within the basic framework of 3D LAS. The 3D interrelationships of Greek property law with other aspects of the Greek legal system related to real estate (rights, use, development, restrictions, and rules) are analysed in detail. Special emphasis is given to the analysis of the interactions of Greek property law with urban planning legislation and the procedures for the recognition and identification of arbitrary constructions and the issuance of building permits, which have recently been revised at the 3D level.

2. GREEK PROPERTY LAW

The Greek Civil Code, which was introduced in 1946, replacing the previous Byzantine-Roman law, introduced the Greek Property Law (GPL) Book 3, as a bundle of rules for the integrated legal and technical on properties and property rights, and at a three-dimensional level (Perperidou et al. 2021). The GPL determines the three-dimensional legal aspect of properties and property rights, through the categorisation of property rights, the restrictions on their exercise, especially for reasons of public interest, the application of rules for their efficient organisation and their publicity (Balis 1951; Perperidou et al. 2021) At the same time, the GPL completely separated the rules of immovable property and the rights exercised over it from the rules of spatial and urban planning, which had been dealt with in a uniform manner in the pre-existing Byzantine-Roman law. This separation not only facilitated the full implementation of the GPL, but also the proper implementation of spatial and urban planning and land management, but also created serious problems in correlating the legal-technical definition of property and property rights with land management, especially at the three-dimensional level.

Like all laws, Greek property law is constantly evolving, being redefined and reformulated in order to describe effectively and without exception the rights exercised or imposed over immovable property, as well as their limitations, in a complex and multi-level modern world. Furthermore, and because the various aspects of the Greek legal system, such as urban planning, the efficient organisation of rural areas, forestry legislation, expropriation legislation, the exploitation of natural resources, etc., can be better monitored through a solid and LAS. These needs have become more urgent with the introduction of cadastral surveying and the operation of the Cadastre in Greece since 1995.
In addition, as in the last decade, property rights that were abolished with the introduction of the Greek Property Code in 1946, such as the right of surface ownership, have been reintroduced in the case of private real estate of the public sector, public legal entities and other entities controlled by the public sector, as an optimal way to manage and use it, so that the public sector can respond adequately to the modern challenges of land management and the effective exploitation of its real estate, without having to lose ownership of it. Nowadays, with the completion of the Cadastre in Greece and the ever increasing and pressing need for the proper and effective organisation of space to ensure the sustainability of the man-made, natural and cultural environment in Greece, the 3D technical/spatial description of the legally described 3D property rights and their limitations in a 3D LAS perspective is of great importance.

2.1 3D Rights and Limitations under Greek Legislation An Overview

As presented by Perperidou et.al. (Perperidou et al. 2021), although under Greek legislation the legal aspects of 3D objects, 3D spaces, 3D rights and 3D restrictions on the use of real estate have been firmly described in legal documents and laws over time, their 3D technical representation does not exist, but only their partial 2D representation, Table 1.

Table 1: Legal and Technical 3D Rights & Restrictions on Properties Comperative Analysis (Source: Perperidou et al. 2021).

Thing/ Right/restriction	Legal Framework	Legal Binding Document	3D legal description	3D Representation
Immovable thing	PL	Deeds/ official governmental or administrative acts	YES	No/ Only 2D boundary drawing
Ownership right	PL	Deeds/ official governmental or administrative acts	YES	NO
Property division - horizontal/ vertical/ vertical combined to horizontal	PL/ L.3741(1929)/ urban plannig regulations	Deed	YES	NO/ 2D boundary drawing and 2D top views, cross section & longitudinal model
Trees (rights-restrictions)	PL / urban plannig regulations	Under conditions in Deeds or officially approved building permit	YES	NO/ in some cases of building permits only 2D position
Rain water natural flow agricultural areas	PL	In some cases by court decision	YES	NO/ 2D legal description in court decision
Rain water natural flow residential buildings	PL	None	YES	NO/ Under conditions in 2D top views, cross section & longitudinal model of officially approved building permit
Spring/ Sping village water supply	PL	Deeds/ court decisions	YES	NO/ 2D bounary or water supply network drawing
Rights of way	PL	Deeds/ official governmental or administrative acts/ court decision	YES	NO/ 2D width length topographic diagram
Utility Network Easement	PL/ specific legislation on utility networks legal entities	Court decision (on the bases of expropriation rules)	YES	NO/ linear determination, width discribed by word content - hight or depth discribed by word content
Mines	PL/ L. ΓΦΚΔ (1910)/ Mining Code (1973)	Official administrative permit	Yes	NO/ 2D detailed topographic map of surface boundaries, word content on 2d surface boundaries ulimited underground extension
Expropriation	PL/ Expropriation Code	Official administrative acts after court decision	Yes	NO/ 2D detailed topographic diagram of boundaries and all things firmly connected to the ground (over or under)
Seashore & beach borderline	PL/ L. on Seashore and Beach	Official administrative decision	YES	NO/ 2D detailed topographic diagram, seashore borderline can enter the sea in case of officially approved constructions
Surface ownership right	L. 3986 (2011)/ urban plannig regulation	Contract after offcial administrative decision or law	YES	NO/ 2D detailed topographic diagram of property boundaries on which surface owership right is exercised/ 2D top views, cross section & longitudinal model of officially approved building permit

Furthermore, 3D environmental restrictions that are provided in both urban legislation and PL are not adequately technically represented in 3D level, (Perperidou and Xydopoulos 2021), while currently there are serious inconsistencies amongst 2D cadastral spatial data and 2D urban plans technical provisions, causing serious problems in urban development and overall land administration in Greece (Perperidou 2023). Similarly, the lack of correlation between the legal descriptions of property rights in Greece's Cadastre and their spatial evolution over the years can cause a number of problems in land administration, especially after major disasters such as the catastrophic Mati and Kokkino Limanaki forest fires of 2021, which claimed the lives of 102 people and left many more injured and homeless (Perperidou 2020). It is worth noting that the redevelopment of the Mati and Kokkino Limanaki areas under firm urban and spatial planning regulations has not been achieved so far due to the lack of solid and official 3D spatial data and a firm 3D LAS.

Moreover, since 2011, all real estate transactions in Greece must include a technical description of the status of the property in terms of the legal provisions on building permits, the existence of any structures that should be legalised, and the legalisation process includes a

series of 2D top views, cross-sectional and longitudinal models, while since 2021 the Building Electronic Identity is mandatory in any real estate transaction. In parallel, and since 2018, all building permits will be issued through an electronic system that requires the submission of the official topographical plan of the parcel referenced to the official Greek reference system (EPSG 2100). In cases where there is a discrepancy between the official topographical plan of the permit and the 2D cadastral spatial documentation of the plot/land parcel, the permit may not be issued, resulting in a loss of time and money for the landowner.

In addition, a series of decisions of the Council of State in 2023 regarding the validity of issued building permits in relation to the status of the road network of outer urban and rural areas where no urban plans are in force, has put on hold not only the issuance of urban permits, but also property transactions. In the context of these developments, the Greek government was forced to announce the acceleration of spatial planning through Local Urban Plans - LUP (only 33% of Greece's territory is covered by LUP) and to launch, by presidential decree, an extensive technical programme for the official recognition of existing roads in outer urban and rural areas in order to overcome the problems raised by the Council of State.
The catastrophic floods of September 2023 in Thessaly, which claimed the lives of 18 people and more than 100,000 domestic animals, leaving thousands homeless and jobless, due to the extensive flooding of some 720 square kilometres of highly productive farmland and pastures, and which cut the country in two as the national road and the railway linking Athens to Thessaloniki were put out of service, with the estimated cost of recovery running into billions (Kantouris 2023), brought the need for integrated spatial planning, property rights and land management to the center of the debate. It is worth noting that in Thessaly the refugees of the 1922 Minor Asia catastrophe were settled, so there was a comprehensive plan of urban/settlement network and rural land organisation, accompanied by the desiccation of Lake Carla, which after 2000 is in the process of regeneration (after the flood is fully regenerated), while there are certain issues and questions about the state's policies on water resources management, flood protection works and the overall land administration process and implementation of legislation, while there are growing voices demanding large scale settlements relocation.

3. 3D PROPERT RIGHTS IN GREECE FROM THE PERSPECTIVE OF 3D LAS

Both the GPL and the cadastral legislation have specific provisions on properties and the exercise of property rights in relation to the common interest and the common good, constituting a sphere of public power in the exercise of private property rights and ensuring the sustainable development of Greece through the precise spatial definition of parcels and the restrictions/regulations imposed on them (Balis 1951; *Law 2664 on Hellenic Cadastre Operation* 1998). However, there is still no fixed technical description of the properties, such as plots/land parcels /buildings/condominiums - separate ownership and property rights, nor of the rules/regulations and restrictions imposed on the properties, which leads to a number of problems and complications for property use, land management and land administration, as analysed in Section 2 and Subsection 2.1.

Due to the specificities of the GPL and the National Cadastre legislation, and their integration with relevant legislation on regulations or restrictions of property rights imposed by urban and spatial planning legislation, forestry legislation, agricultural legislation and even water management legislation, it is preferable to analyse their 3D aspect in the context of a future Greek 3D LAS, rather than to adapt it to an existing prototype.

3.1 3D Property Rights in Greece and 3D LAS

As mentioned above, the GPL covers not only the legal but also the technical aspects of property and property rights in a three-dimensional level. The definition of immovable property also includes basic provisions on land management in the public interest, as shown in Figure 1.

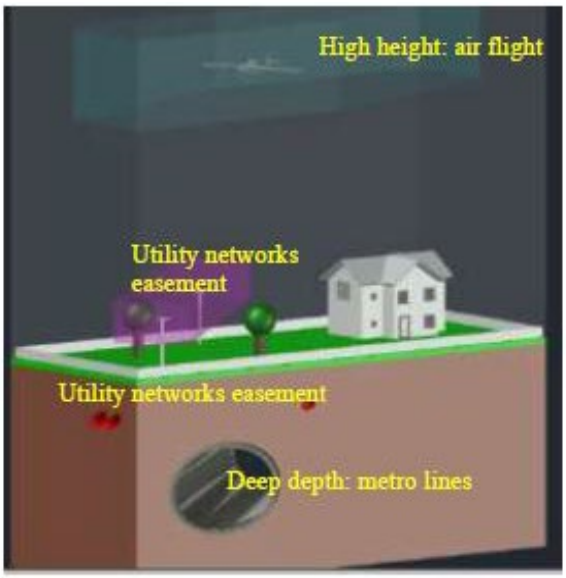

Figure 1: Immovable think and ownership right according to Greece's PL and common good restrictions (Source: Perperidou et al. 2021)

The GPL itself contains clear provisions on water resources management (Perperidou et al. 2021), environmental pollution and zoning (Perperidou and Xydopoulos 2021), urban planning implementation (Perperidou et al. 2021; Perperidou and Xydopoulos 2021), utility networks easements (Perperidou et al. 2021), mine development and underground network development (Perperidou et al. 2021; Perperidou, Sigizis, and Chotza 2021) which can be displayed in 3D. In parallel, official administrative acts such as urban and spatial plans, including those of the Ministry of Agriculture, sea and beach borders, expropriations, which are approved by presidential decree and represented in 2D detailed topographic/cadastral diagrams, which are not always referenced to the official Greek reference system (ESPG 2100) (Perperidou et al. 2021).

Furthermore, the operational cadastral base or the ongoing cadastral survey presents inconsistencies, on the one hand, in the integration of the official acts diagrams into the Hellenic Cadastral Database, and on the other hand, in the accurate representation of the parcel/plot boundaries due to acceptable accuracy deviations that are foreseen in the cadastral survey but are prohibited in the operational cadastre. These inconsistencies are the result of

medium or large errors during the cadastral survey, but also due to transformation errors between the different reference systems used in Greece and the current one, the ESPG 2100 (Ampatzidis, Kotsakis, and Katsambalos 2011; Moschopoulos et al. 2020). Thus, for the 3D representation of property rights, properties and spatial objects in general, transformation errors and standard deviations need to be taken into account. Thus, and with respect to the 3D LAS principles and models as presented by scholars (e.g. (Kalogianni et al. 2020), the basic principles of geodesy and reference systems must be taken into consideration when it comes to the 3D representation of property rights, properties and administrative acts in Greece, by adapting the current cadastral database, either the operational Cadastre or the ongoing cadastral survey, to these principles. According to the provisions of the 3D LAS system, the 3D representation of property rights in Greece should provide for and include the following:

- Plot/ land parcel 2D depiction in respect to reference systems transformations principles/ equations (in respect to ESPG 2100)
- Plot/ land parcel vertical depiction in respect to reference systems transformations principles/ equations (in respect to ESPG 2100)
- Adjustment/ correction of existing cadastral parcels to reference systems transformations principles/ equations (in respect to ESPG 2100).
- Plot/ land parcel use or main use
- Plot/ land parcel legal documentation (titles, deeds, other legal binding documents etc.)

With regard to property restrictions/regulations imposed by official legislation, e.g. urban and spatial plans, building codes, protection of cultural heritage, protection of forests, management of water resources, etc., or by official acts that are still in force, e.g. land distribution or redistribution to farmers, easements for utility networks, expropriations, exploitation of mines, etc., and according to the provisions of the 3D LAS system, the 3D representation of Greek restrictions and regulations on properties/property rights should provide for and include:

- 2D official plans/ cadastral – topographic diagrams depiction in respect to reference systems transformations principles/ equations (in respect to ESPG 2100)
- Official plans/ cadastral – topographic diagrams vertical depiction in respect to reference systems transformations principles/ equations (in respect to ESPG 2100)
- Adjustment/ correction of existing cadastral parcels/ spatial entity/ spatial layer to reference systems transformations principles/ equations (in respect to ESPG 2100)
- 2D spatial distribution or prediction maps or natural phenomena (e.g. water resources management, flooding prediction, cold or hot spots of various phenomena, etc.) in respect to DTM/ vertical depiction with direct reference to systems transformations principles/ equations (in respect to ESPG 2100)
- Legal documentation of official acts
- Legal documentation of development/ sustainable development principles/ goals/ axes

Based on the above-mentioned 2D representations of either properties/property rights or institutional regulations and their vertical representation, 3D parcels or volumes can be created and form the basic level of the 3D LAS of Greece. Thus, not only the legal spaces would be adequately described, but also they would be adjusted to the concurrent values and statuses or the official reference system, facilitating either the 4D (including time) transition

of the 3D LAS or the geodetic adjustment/correction/modification of the 2D vertical aspect of those 3D legal spaces to the concurrent geodetic conditions of the official reference system diversification - evolution.

3.2 Building Code and Identification of Arbitrary Structures in Greece in the Context of 3D LAS

The Greek Building Code includes the entire regulatory framework for building regulations, while its detailed and analytical technical specifications are officially documented by the General Building Regulations, the Sanitary and Environmental Regulations, which are issued by Ministerial Decisions officially published in the Official Gazette of the Hellenic Republic. Building permits should follow not only the regulations and specifications of the Building Code, but also the regulations/provisions of urban/spatial planning, especially with regard to the volume and height of buildings and their use.

Both the Building Code (including its specifications) and urban/spatial planning are periodically amended and modified, resulting in the diversification of institutional regulations/restrictions on real estate construction activities over the years.

Since 2011, and following the implementation of legislation on the legalisation of arbitrary constructions, all building permits and property transactions must identify and include any arbitrary construction that should be legalised first. However, as building permits are issued in different years, when different building, urban or spatial planning regulations were in force. Thus, the determination of the chronological evolution of both the Building Code and the Urban or Spatial Planning regulations in 3D level is essential not only for the determination of the legal or arbitrary constructions and the precise building volume, but also for the issue of concurrent building permits, especially in plots/land parcels with existing building activity.

Moreover, the spatio-temporal identification of building volumes and buildings in general is the fundamental element of LA and the initiation of development programmes such as the transfer of development rights (Perperidou et al. 2020) and the land bank, which is foreseen in the current Building Code as a prerequisite for the completion of the legalisation of arbitrary constructions.

According to the Greek legal framework, not only in the concurrent past but also in the past, building permits provide basic technical but also firm legal commitments on the legal status of the plot/land bank in terms of GPL and property rights, as well as its urban planning status (e.g. building factor, maximum building height, building use, etc.) and its status in terms of restrictions imposed by various government agencies such as the Archaeological Service, the Water Resources Authority, the Ministry of Agriculture in the case of land bank in rural areas.

After 2011, all topographic maps submitted for building permits must be referenced to the official Greek reference system, ESPG 2100, at a scale of up to 1/500, and should be mandatory:

- Detailed 2D topographic depiction of the plot/ land parcel and its area with direct reference to its legal status (titles, owners, etc.). In case of operational Cadastre the plot's/ parcel's cadastral code
- Detailed 2D topographic depiction of the existing or the future buildings
- Altimetric curves
- Urban plan's institutional lines, e.g. building line, building distance from boundaries and facade, etc. and extract from the urban in the area

- Building regulations and restrictions, e.g. building factor, maximum building height, maximum building surface coverage, building use or plot's/ land parcel's non buildable zones etc.
- Distance from streams, rivers, seashore, utility networks easements or any other institutional borderline that might restrict building activities
- Archeological agency approval in case of plots/ land parcels located in declared archeological areas or in case of listed building

Besides the detailed topographic diagram building permits also obligatory include:

- Building diagram in which the building volume as 2D representation and vertical section
- Top views of each floor and cross sections of all building sides, as well as longitudinal model a sketch
- Reinforced concrete views for each floor and the foundations
- Utilities network routing top views for each floor
- Building permit official license

All building permit documents and drawings are submitted to the State's official platform for issuing building permits in pdf format. In the case of the legalisation of arbitrary constructions, the official topographic plan, the design plan, as well as the top views and sections of the building permit must be adapted to the current Greek Reference System (ESPG 2100) and any deviation between the official building permit and the actual construction must be documented in drawings, legally described in a technical report and submitted to the State's official web platform for the legalisation of arbitrary constructions in pdf format. In this context, the issuing of building permits and the legalisation of arbitrary constructions in Greece include the main principles of LA in 2.5 dimensional aspect, even though the concurrent legal framework refers to 3D legal spaces and objects. Thus, a Greek 3D LAS that would include building permits and legalisation of arbitrary constructions must have detailed information on the official spatiotemporal evolution of building volumes together with the detailed spatiotemporal diversification of official building regulations and restrictions, including specific geodetic rules on reference systems transformations and evaluation.

4. CONCLUSIONS

In Greece, both property law and land law, as well as technical legislation as it is specialised at the level of urban planning, management of natural resources such as water, expropriation, definition of the seashore, etc., are not limited to the technical dimension, but affect the clear and strict legal definition of 3D spaces and 3D objects. And it is precisely this precision of the technical and legal definition of 3D spaces and objects of technical and real estate legislation in general that makes it a potential LAS, which has not been fully and unified by 3D spatial and topological rules. Even the process of issuing building permits and dealing with unauthorised buildings is in itself a process that is subject to LAS rules for each individual property, even if it is still at the 2.5 level. Consequently, any process of consolidation or its implementation under a Greek LAS and even 3D may be less complex than one might imagine.

Future research should focus on the refinement of topological rules at the 2D and 3D levels, taking into account the strict rules of geodesy and transformations between reference systems, as a multitude of administrative acts and institutional lines are embedded in the previous reference systems. The substantial connection between the current and previous reference systems can be the first step for the construction of an integrated 3D LAS in Greece, in which the documentation of spatial information can also be legally guaranteed, while 3D legal spaces and 3D legal objects can be attributed with spatial accuracy, enabling the development of a 3D LAS.

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BIOGRAPHICAL NOTES

Dr. Dionysia – Georgia Ch. Perperidou is Assistant Professor, University of West Attika, Department of Surveying and GeoInformatics Engineering, in the field of Cadastre, GIS, Urban Planning and Technical Legislation. Has over 15 years of experience in Hellenic Cadastre, head of Athens & Voula/Vouliagmeni Survey Offices. Scientific advisor at Hellenic Republic Asset Development Fund/ Helliniko project, Public Properties Company SA, Independent Power Transmission Operator SA, on Cadastre, urban planning, integrated technical and legal documentation of large-scale properties and infrastructures.

Dimitrios Vazouras holds a BSc in Public Administration and an MSc in Finance. He is currently working in a consultancy company in the field of credit and debt management and is attending the Master's Programme "Land Management & Real Estate", Department of Surveying and Geoinformatics Engineering, School of Engineering, University of Western Attica and is about to defend his Master's thesis.

Ioanna Kloukina holds a BSc in Business Administration. She is an official of the Ministry of Finance and is attending the Master's Programme "Land Management & Real Estate", Department of Surveying and Geoinformatics Engineering, School of Engineering, University of Western Attica and is about to defend his Master's thesis.

Dimitrios Papastamou layer, LL.M. He runs his own law firm, with specialization on real estate transactions and Cadastre and is attending the Master's Programme "Land Management & Real Estate", Department of Surveying and Geoinformatics Engineering, School of Engineering, University of Western Attica and is about to defend his Master's thesis.

CONTACTS

Dr. Dionysia – Georgia Ch. Perperidou
University of West Attica,
Agiou Spyridonos, Aigaleo, GREECE
Tel. +306936852526,
Email: dgperper@uniwa.gr
Web site: https://geo.uniwa.gr/profile/perperidoy-dionysia-georgia/

Dimitrios Vazouras
University of West Attica,
Agiou Spyridonos, Aigaleo, GREECE
Email: lmre21102@uniwa.gr

Ioanna Kloukina
University of West Attica,
Agiou Spyridonos, Aigaleo, GREECE
Email: lmre21108@uniwa.gr

Dimitrios Papastamou
University of West Attica,
Agiou Spyridonos, Aigaleo, GREECE
Email: lmre21100@uniwa.gr