



## ΠΑΡΟΥΣΙΑΣΗ ΔΙΔΑΚΤΟΡΙΚΗΣ ΔΙΑΤΡΙΒΗΣ

**ΗΜΕΡΟΜΗΝΙΑ:** Δευτέρα, 13 Ιουλίου 2026  
**ΩΡΑ:** 10:00 - 12:00  
**ΑΙΘΟΥΣΑ:** Αίθουσα Σεμιναρίων, ΤΜΗΥΠ  
**ΟΜΙΛΗΤΗΣ:** Βασίλειος Βουρονίκος

### Θέμα

### **«Algorithmic Techniques for Information Hiding and Digital Object Protection»**

#### **Επταμελής Εξεταστική Επιτροπή:**

1. **Σταύρος Δ. Νικολόπουλος**, Καθηγητής, Τμήμα Μηχανικών Ηλεκτρονικών Υπολογιστών και Πληροφορικής, Πανεπιστήμιο Ιωαννίνων (επιβλέπων)
2. **Λουκάς Γεωργιάδης**, Καθηγητής, Τμήμα Μηχανικών Ηλεκτρονικών Υπολογιστών και Πληροφορικής, Πανεπιστήμιο Ιωαννίνων.
3. **Εμμανουήλ Μάγκος**, Καθηγητής, Τμήμα Πληροφορικής, Ιόνιο Πανεπιστήμιο
4. **Ευριπίδης Μάρκου**, Καθηγητής, Τμήμα Μηχανικών Ηλεκτρονικών Υπολογιστών και Πληροφορικής, Πανεπιστήμιο Ιωαννίνων
5. **Μιχάλης Μπέκος**, Αναπληρωτής Καθηγητής, Τμήμα Μαθηματικών, Πανεπιστήμιο Ιωαννίνων
6. **Γιάννης Σταματίου**, Καθηγητής, Τμήμα Διοικητικής Επιστήμης και Τεχνολογίας, Πανεπιστήμιο Πατρών
7. **Χρήστος Τζώρτζης**, Καθηγητής, Σχολή Επιστημών Τεχνολογίας, Διεθνές Πανεπιστήμιο Ελλάδος

### Περίληψη

With the rapid expansion of digital technologies and multimedia distribution, protecting digital content against forgery, unauthorized modification, and ownership violations has become a pressing research challenge—particularly in fields like digital forensics, healthcare, surveillance, and electronic communication, where content authenticity and integrity are essential.



This dissertation presents a comprehensive collection of robust and fragile watermarking and information hiding techniques designed to safeguard images, audio recordings, videos, and electronic documents.

For authenticity preservation, the work introduces several novel approaches: image watermarking models using Self-Inverting Permutations (SiPs) embedded in the frequency domain, including both single and multiple watermark variants for improved capacity, security, and robustness; the ROMFAIA framework, which integrates robust frequency-domain authenticity preservation with fragile spatial-domain integrity verification for forensic medical images; a dual-layer audio watermarking method combining image watermarking with least significant bit embedding; a hash-chain video watermarking framework integrating frequency-domain techniques with cryptographic frame-audio verification; and a QR-code-based PDF watermarking scheme incorporating scrambling and permutation mechanisms.

For integrity preservation, the dissertation proposes fragile watermarking techniques across multiple media types, including a cryptographic image integrity framework using inter-block verification, hash-based audio tamper detection and localization, and two complementary video integrity frameworks—one using cross-frame and audio-synchronized hash chains, and another employing cross-frame permutation to detect frame addition, deletion, and copy-move manipulations.

All proposed models were rigorously evaluated using metrics such as PSNR, SSIM, BER, NC, Extraction Rate, Precision, Recall, F1-score, Accuracy, and execution time. Results demonstrate strong imperceptibility, robustness against common attacks, computational efficiency, and accurate tamper detection and localization, with comparative evaluations confirming competitiveness against existing literature.

Overall, this work delivers a unified, scalable framework for digital media protection by combining frequency- and spatial-domain embedding strategies with combinatorial encoding structures and cryptographic verification mechanisms—offering effective solutions for authenticity and integrity preservation across diverse digital content types.