



## Course description in the individual study syllabus for PhD candidates

The course is prepared for the PhD student: Naveed Ahmed


### Course type: DR

Course title in Norwegian:  
GNSS mottaker design – sårbarhet og mottiltak

Course title in English:  
GNSS receiver design – vulnerabilities and countermeasures

Professor  
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Credits	Form of teaching (seminar, lab. course, self study etc.)	Examination type (written/oral)
7.5	<b>Self study</b>	<b>Oral</b>

Place Trondheim	Date <b>04.10.2018</b>	Signature of professor 
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### Course description:

Summary of content (Minimum 100 words)

Safety critical applications as well as public services and consumer products are highly reliant on reliable positioning and navigation from modern Global Navigation Satellite Systems (GNSS). Although GNSS can provide accurate and global positioning, it is vulnerable to a wide range of threats that may originate from both intentional and unintentional radio interference (RFI). GNSS is particularly vulnerable due to its extremely low power level in combination with an ever-increasing use of an already crowded frequency spectrum.

The course will focus on two main topics concerning the use of modern GNSS receivers for positioning and navigation:

1. The course will focus on modern high end GNSS receiver design and emphasize the similarities and differences utilizing all signals from the four major GNSS systems (GPS, GLO, GAL and BDS). The focus will be to exploit the main vulnerabilities to both intentional and unintentional interference in the receiver design.
2. The course will focus on the different types of countermeasures available to overcome the potential threat of intentional and unintentional interference to modern GNSS receivers.

**Literature:**

Author, title, publisher, year, no. of pages in syllabus. Copies of the title page and contents list of each book are to be attached.

Elliott D. Kaplan, Christopher J. Hegarty – Understanding GPS/GNSS, Principles and Applications, Third edition, Artech House, 2017, Ch. 1-6 and Ch. 8-10.

Fabio Dovis – GNSS Interference Threats and Countermeasures, 2015, Artech House, 191 pages.

Humphreys, Todd et. al. – Ch. 16 Interference, Handbook of Global Navigation Satellite Systems, Springer Verlag, 2017, 35 pages.

**Papers in journals**

Author, title, journal, year, volume, no. of pages in syllabus

- G. Dempster and E. Cetin, Interference Localization for Satellite Navigation Systems, IEEE special issue on Vulnerabilities, Threats and Authentication in Satellite-Based Navigation Systems, 2016, Vol. 104, issue 6, 7 pages.
- D. Musicki, R. Kaune R. and W. Koch, Mobile Emitter Geolocation and Tracking Using TDOA and FDOA Measurements, IEEE Transactions on Signal Processing, 2010, Vol. 58, No. 3, 12 pages.
- Kealy, G. Retscher, C. Toth, A. Hasnur-Rabiain, V. Gikas, D. Grejner-Brzezinska, C. Danezis and T. Moore, Collaborative Navigation as a Solution for PNT Applications in GNSS Challenged Environments – Report on Field Trials of a Joint FIG / IAG Working Group, Journal of Applied Geodesy 2015, 9(4), 19 pages.



TECHNOLOGY AND APPLICATIONS SERIES

ELLIOTT D. KAPLAN  
CHRISTOPHER J. HEGARTY  
EDITORS

# UNDERSTANDING GPS/GNSS

PRINCIPLES AND APPLICATIONS

THIRD EDITION

# **Understanding GPS/GNSS**

**Principles and Applications**

**Third Edition**

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TECHNOLOGY AND APPLICATIONS SERIES

**FABIO DOVIS**  
EDITOR

# GNSS

**INTERFERENCE THREATS AND  
COUNTERMEASURES**





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# Springer Handbook of Global Navigation Satellite Systems

Peter J.G. Teunissen, Oliver Montenbruck (Eds.)

With 818 Figures and 193 Tables



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