

# University of Westminster : 24 - Electrical and Electronic Engineering

## RAE 2008 : RA2 - Research outputs

**Name:** Budimir, D.

**Category:** A

**FTE:** 1.00

Identifier: 9710831513255

Year of entry:

Research groups: A - General

### RA2 - Research outputs

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**Output number:** 1 **Output type:** Chapter in book

**Title:**

Waveguide components

**Editors:** Chang, Kai

**Book title:** Encyclopedia of RF and microwave engineering

**Publisher:** Wiley-Interscience

**Year of publication:** 2005

**Pagination:** 5527-5536

**ISBN:** 0471270539

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

**Other relevant details:**

The results presented in this output were largely achieved through realisation of a research "Waveguide Filters with Improved Stopband Performance and Novel Antenna Filters for Millimeter-wave Applications" sponsored by EPSRC (grant GR/M58634/01). The research presented here contributed to the development of "EPFIL-Waveguide E-plane Filter Design", Software and User Manual, ISBN 1-58053-083-4, Artech House Books, a commercial software package which is used by more than 1000 companies and universities all over the world.

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**Output number:** 2 **Output type:** Journal article

**Title:**

Design of asymmetrical RF and microwave bandpass filters by computer optimization

**Journal title:** IEEE Transactions on Microwave Theory and Techniques

**Month/year of publication:** April 2003

**Pagination:** 1174-1178

**Volume:** 51(4, part 1)

**ISSN:** 0018-9480

**URL:** <http://dx.doi.org/10.1109/TMTT.2003.809623>

**DOI:** 10.1109/TMTT.2003.809623

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

1: Goussetis, G.

External author: No

**Other relevant details:**

The paper presents selected results of research sponsored by EPSRC "Waveguide Filters with Improved Stopband Performance and Novel Antenna Filters for Millimeter-wave Applications" (grant GR/M58634/01). This research has contributed to the development of "EPFIL-Waveguide E-plane Filter Design", Software and User Manual, ISBN 1-58053-083-4, Artech House Books, a commercial software package which is used by more than 1000 companies and universities all over the world.

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**Output number:** 3 **Output type:** Journal article

**Title:**

Improvement of third-order intermodulation product of RF and microwave amplifiers by injection

**Journal title:** IEEE Transactions on Microwave Theory and Techniques

**Month/year of publication:** June 2001

**Pagination:** 1148-1154

**Volume:** 49(6, part 2)

**ISSN:** 0018-9480

**URL:** <http://dx.doi.org/10.1109/22.925508>

**DOI:** 10.1109/22.925508

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 1

1: Aitchison, C.S.

External author: Yes

2: Mbabele, M.

External author: Yes

3: Moazzam, M.R.

External author: Yes

**Other relevant details:**

This paper presents outcomes of a collaborative project with Brunel University. The project was supported by a 2-year EPSRC grant "New Technique for Reduction of Amplifier Intermodulation".

## University of Westminster : 24 - Electrical and Electronic Engineering

### RAE 2008 : RA2 - Research outputs

**Output number:** 4 **Output type:** Journal article

**Title:**

Miniaturised rectangular waveguide filters

**Journal title:** International Journal of RF and Microwave Computer-Aided Engineering

**Month/year of publication:** July 2007 **Pagination:** 398-403 **Volume:** 17(4)

**ISSN:** 1096-4290

**URL:** <http://dx.doi.org/10.1002/mmce.20238>

**DOI:** 10.1002/mmce.20238

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

1: Shelkovnikov, A.B.

**External author:** No

**Additional authors:** 0

**Other relevant details:**

The paper presents selected results of research sponsored by EPSRC "Novel 3D Multilayer Passive MIC and MMIC Components for Microwave and Millimetre-wave Applications" (Reference: 00312760). The work provides solutions of miniaturisation and performance improvement of filter structures and demonstrates the advantages of employing electromagnetic bandgap structures and left-handed materials. The use of metamaterial technologies in novel ways to provide new system options has been identified by EPSRC as one of its long-term interests.

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# University of Westminster : 24 - Electrical and Electronic Engineering

## RAE 2008 : RA2 - Research outputs

**Name:** Kale, I.

**Category:** A

**FTE:** 1.00

Identifier: 8410831239469

Year of entry:

Research groups: A - General

### RA2 - Research outputs

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**Output number:** 1 **Output type:** Journal article

**Title:**

Quantization effects in the polyphase N-path IIR structure

**Journal title:** IEEE Transactions on Instrumentation and Measurement

**Month/year of publication:** December 2002 **Pagination:** 1271-1278

**Volume:** 51(6)

**ISSN:** 0018-9456

**URL:** <http://dx.doi.org/10.1109/TIM.2002.808032>

**DOI:** 10.1109/TIM.2002.808032

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

1: Krukowski, A.M.

External author: No

2: Morling, R.C.S.

External author: No

**Other relevant details:**

This paper provides theoretical analysis, backed up by validating simulation studies for practical noise considerations for the design and implementations of polyphase N-path filter structures. The results of this work were commercially used in the Hearing Aid ICs by Zarlink Semiconductor Inc., USA. Contact Person at Zarlink was Dr. S. J. Morris, who was up until recently Director of Research at Zarlink, and is currently VP, Engineering Nanotech Semiconductor Ltd., UK.

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**Output number:** 2 **Output type:** Journal article

**Title:**

Rigorous analysis of delta-sigma modulators for fractional-N PLL frequency synthesis

**Journal title:** IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications

**Month/year of publication:** June 2004 **Pagination:** 1148-1162

**Volume:** 51(6)

**ISSN:** 1057-7122

**URL:** <http://dx.doi.org/10.1109/TCSI.2004.829308>

**DOI:** 10.1109/TCSI.2004.829308

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

1: Kozak, M.

External author: Yes

**Other relevant details:**

This paper is the first in the literature to provide a rigorous theoretical analysis and understanding of the issues relating to the Delta-Sigma modulators deployed as the fundamental building block for Fractional-N Frequency Synthesizers. The results of this work were commercially used in Fractional-N Frequency Synthesizers by NOKIA, Camberley, UK, and a joint patent in the Fractional-N Synthesiser area filed. The results of this work were also commercially used in their ICs by, Beceem Communications Inc., USA. Contact Person at Beceem is Dr. T. Bourdi, who was formerly with NOKIA, Camberly, UK.

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**Output number:** 3 **Output type:** Journal article

**Title:**

Modeling of switched-capacitor delta-sigma Modulators in SIMULINK

**Journal title:** IEEE Transactions on Instrumentation and Measurement

**Month/year of publication:** August 2005 **Pagination:** 1646-1654

**Volume:** 54(4)

**ISSN:** 0018-9456

**URL:** <http://dx.doi.org/10.1109/TIM.2005.851085>

**DOI:** 10.1109/TIM.2005.851085

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

1: Shoaie, O.

External author: Yes

2: Zare-Hoseini, H.

External author: No

**Other relevant details:**

At ISCAS'05, the authors were approached by Prof. Franco Maloberti of the Analog and Mixed-Signal-Center, Texas A&M University, who asked for permission to include the modelling environment of this paper in his University of Pavia- based group's popular online Toolbox.

The results of this work were commercially used in the Hearing Aid ICs by, Zarlink Semiconductor Inc., USA. Contact Person at Zarlink was Dr. S. J. Morris, who, until recently, was the Director of Research at Zarlink, and currently is a VP at Engineering Nanotech Semiconductor Ltd., UK.

## University of Westminster : 24 - Electrical and Electronic Engineering

### RAE 2008 : RA2 - Research outputs

**Output number:** 4 **Output type:** Journal article

**Title:**

Partial equalization of non-minimum-phase impulse responses

**Journal title:** EURASIP Journal on Applied Signal Processing

**Month/year of publication:** February 2006 **Pagination:** 1-8

**Volume:** 2006(Article ID 67467)

**ISSN:** 1110-8657

**URL:** <http://dx.doi.org/10.1155/ASP/2006/67467>

**DOI:** 10.1155/ASP/2006/67467

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

1: Daoud, B.

External author: Yes

2: Krukowski, A.M.

External author: No

3: Maamar, A.

External author: Yes

**Additional authors:** 0

**Other relevant details:**

A modified version of the homomorphic method for minimum-phase inverse-filter design for non-minimum-phase impulse-response equalization is presented. The approach is particularly useful for partial magnitude equalization. Although it is used here as an additional optimizing for psychoacoustic quality enhancement and measurement of speech, this approach is very advantageous in the case of direct inverse filtering of minimum-phase systems when perfect equalization of a small reverberant environment is not desired. Results presented were from sample impulse-responses taken from a car and proved very effective. The commercial application of this method in a real-time teleconference environment is currently underway with promising results.

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# University of Westminster : 24 - Electrical and Electronic Engineering

## RAE 2008 : RA2 - Research outputs

**Name:** Kodogiannis, V.

**Category:** A

**FTE:** 1.00

Identifier: 9910831686014

Year of entry:

Research groups: A - General

### RA2 - Research outputs

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**Output number:** 1 **Output type:** Journal article

**Title:**

Soft computing based techniques for short-term load forecasting

**Journal title:** Fuzzy Sets and Systems

**Month/year of publication:** June 2002 **Pagination:** 413-426

**Volume:** 128(3)

**ISSN:** 0165-0114

**URL:** [http://dx.doi.org/10.1016/S0165-0114\(01\)00076-8](http://dx.doi.org/10.1016/S0165-0114(01)00076-8)

**DOI:** 10.1016/S0165-0114(01)00076-8

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

1: Anagnostakis, E.M.

External author: No

**Other relevant details:**

This paper is dealing with short-term power load forecasting. It is necessary for the power suppliers to have an accurate predictive model to measure the power load needs. Many techniques have been applied to this topic, including linear and nonlinear approaches. The methodologies in this paper overcome some of the current limitations of the techniques used for this problem. The spread-encoding MLP, a neuro-fuzzy scheme and two novel short-term recurrent neural networks outperformed the classical autoregressive modelling scheme and the MLP network. These schemes have been evaluated using real data from the Greek Power Corporation for the island of Crete.

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**Output number:** 2 **Output type:** Journal article

**Title:**

The use of gas-sensor arrays to diagnose urinary tract infections

**Journal title:** International Journal of Neural Systems

**Month/year of publication:** October 2005 **Pagination:** 363-376

**Volume:** 15(5)

**ISSN:** 0129-0657

**URL:** <http://dx.doi.org/10.1142/S0129065705000347>

**DOI:** 10.1142/S0129065705000347

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

1: Wadge, E.

External author: No

**Other relevant details:**

Electronic nose is one of the emerging technologies in sensorial analysis and one of the most important investigation methods in food and chemical analysis. In this paper, an electronic nose has been used to detect rapidly (4-5hours) in vivo Urinary Tract Infections from suspected cases received at an NHS Trust. A novel Extended Normalised Radial Basis Function network with advanced features for determining its size and parameters and the concept of fusion of multiple-classifiers dedicated to specific feature parameters has been implemented. Results have shown the potential for early detection of microbial contaminants in urine samples using electronic nose technology.

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**Output number:** 3 **Output type:** Journal article

**Title:**

Neuro-control of unmanned underwater vehicles

**Journal title:** International Journal of Systems Science

**Month/year of publication:** February 2006 **Pagination:** 149-162

**Volume:** 37(3)

**ISSN:** 0020-7721

**URL:** <http://dx.doi.org/10.1080/00207720600566495>

**DOI:** 10.1080/00207720600566495

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

**Other relevant details:**

Unmanned underwater vehicles typically operate in uncertain and changing environments. Since their dynamics are highly nonlinear and their hydrodynamic coefficients vary with different operating conditions, a high-performance control system is needed to have the capacities of learning and adaptation to the variations in the vehicle's dynamics. This paper presents the utilisation of an adaptive neuro-control scheme as a controller for controlling a vehicle in six degrees of freedom. All the analysis, included stability issues are addressed in the paper. The research work was part of the "FREESUB-Autonomous Submarine for inspection and intervention", Human Potential European Research Training Network- 5th Framework.

## University of Westminster : 24 - Electrical and Electronic Engineering

### RAE 2008 : RA2 - Research outputs

**Output number:** 4 **Output type:** Journal article

**Title:**

The usage of soft-computing methodologies in interpreting capsule endoscopy

**Journal title:** Engineering Applications of Artificial Intelligence

**Month/year of publication:** June 2007 **Pagination:** 539-553

**Volume:** 20(4)

**ISSN:** 0952-1976

**URL:** <http://dx.doi.org/10.1016/j.engappai.2006.09.006>

**DOI:** 10.1016/j.engappai.2006.09.006

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

1: Boulougoura, M.

External author: No

2: Lygouras, J.N.

External author: Yes

3: Wadge, E.

External author: No

**Other relevant details:**

Wireless capsule endoscopy (WCE) constitutes a novel technology in which a capsule with micro-camera attached to it, is swallowed by the patient. This paper presents an integrated methodology for detecting abnormal patterns in WCE images. Advanced imaging and classification techniques based on learning-based methodologies have been utilised in this paper. The detection accuracy of the proposed system provides an indication that such intelligent schemes could be used as a supplementary diagnostic tool in WCE. The research was funded from the "IVP- Intracorporeal Videoprobe" European project and a related patent has been submitted recently.

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# University of Westminster : 24 - Electrical and Electronic Engineering

## RAE 2008 : RA2 - Research outputs

**Name:** Madani, K.

**Category:** A

**FTE:** 1.00

Identifier: 9210831410052

Year of entry:

Research groups: A - General

### RA2 - Research outputs

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**Output number:** 1 **Output type:** Conference contribution

**Title:**

A novel generic distributed intelligent re-configurable mobile network architecture

**Conference:** IEEE VTS 53rd Vehicular Technology Conference, Spring, 2001, May 6-9, 2001, Rhodes, Greece

**Month/year of publication:** 06/05/2001 **Number of pages:** 1927-1931

**Media of output:**

**ISSN:** 1090-3038

**URL:** <http://dx.doi.org/10.1109/VETECS.2001.945031>

**DOI:** 10.1109/VETECS.2001.945031

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:**

1: Ramos, R.E.

External author: No

**Other relevant details:**

The paper has contributed to a novel vision of Software Radio architecture, which formed the basis for a major EC-Funded research project CAST. This concept has provided a solid foundation and played a central role in providing a suitable context in which to examine reconfigurability issues in the Mobile Terminal and Base Station. It is envisaged that this concept has the potential to help the telecommunications industry in facilitating; the introduction, development and harmonization of reconfigurability within existing and future fixed and mobile networks.

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**Output number:** 2 **Output type:** Authored book

**Title:**

Software defined radio, volume 4: architectures, systems and functions

**Publisher:** Wiley

**Year of publication:** 2003

**Number of pages:** 416

**ISBN:** 0470851643

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

1: Alonistioti, N.

External author: No

2: Dillinger, M.

External author: No

**Other relevant details:**

This book has been created to complement the previous three volumes, as the scientific reference for the state-of-the-art research in 'Software Radio'. As well as acting as the main Editor, Prof. K. Madani has co-authored Chapter 5: Network Architectures and Functions, and Chapter 6: Self Learning and Adaptive Systems, by describing novel and innovative techniques in these fields. It is now commonly agreed that the desired functions for systems beyond 3G can not be achieved without performing intelligent monitoring and identification of the available radio access networks and the relevant network architectures and functions.

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**Output number:** 3 **Output type:** Conference contribution

**Title:**

Applications of ePerSpace Service Management platform in health care

**Conference:** The International Council on Medical Care and Compunetics (ICMCC) Conference, The Hague, Netherlands, 7-9 June 2006

**Month/year of publication:** 07/06/2006 **Number of pages:** 42-46

**Media of output:**

**ISSN:** 0926-9630

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

1: Lohi, M.

External author: No

**Other relevant details:**

This paper proposes use of the ePerSpace architecture solution as the basic infrastructure for personalized healthcare applications. This solution can potentially revolutionize the way the value-added healthcare providers offer their services to users at home. ePerSpace was an EC-funded Integrated Project (IP) under the European Framework 6 Program (FP6), consisting of a research consortium of 20 partners from telecom operators, broadcasters, manufacturers, academia & SMEs. The main objective of the ePerSpace project was to provide a networked audiovisual system with wide ranging applications at home and virtually anywhere, by enabling innovative value-added services.

## University of Westminster : 24 - Electrical and Electronic Engineering

### RAE 2008 : RA2 - Research outputs

**Output number:** 4 **Output type:** Conference contribution

**Title:**

A semi-autonomous generic network for seamless personalised services at home and elsewhere

**Conference:** IEE Forum on Autonomous Systems, Savoy Place, London, UK, 28 Nov. 2005

**Month/year of publication:** 28/11/2005 **Number of pages:** 9

**Media of output:**

**ISSN:** 0537-9989

**URL:** <http://ieeexplore.ieee.org/iel5/10518/33297/01574601.pdf?tp=arnumber=1574601&isnumber=33297>

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 1

1: Lohi, M.

External author: No

2: Terstyanszky, G.

External author: No

3: Zetuny, Y.

External author: No

**Other relevant details:**

The basic infrastructure of the novel ePerSpace architecture for the provisioning of seamless personalized networked audio-visual services at home and outside was presented in this event. This architecture was created as a result of a 2-year EC-Funded European research collaboration involving University of Westminster, BT, France Telecom, Telefonica, Telenor, Siemens, Motorola, RAI, & NRK amongst others. It is envisaged that the ePerSpace open architecture will increase the range of novel services and the speed of developing them, by re-using well-defined system components and their interfaces.

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# University of Westminster : 24 - Electrical and Electronic Engineering

## RAE 2008 : RA2 - Research outputs

**Name:** Tarczynski, A.

**Category:** A

**FTE:** 1.00

Identifier: 9110831374850

Year of entry:

Research groups: A - General

### RA2 - Research outputs

<b>Output number:</b> 1	<b>Output type:</b> Journal article	
<b>Title:</b> On an instantaneous frequency estimator with FIR filters having maximally flat frequency response error magnitude		
<b>Journal title:</b> Signal Processing		
<b>Month/year of publication:</b> July 2001	<b>Pagination:</b> 1491-1501	<b>Volume:</b> 81(7)
<b>ISSN:</b> 0165-1684		
<b>URL:</b> <a href="http://dx.doi.org/10.1016/S0165-1684(01)00046-9">http://dx.doi.org/10.1016/S0165-1684(01)00046-9</a>		
<b>DOI:</b> 10.1016/S0165-1684(01)00046-9		
<b>Is duplicate:</b> No	<b>Is interdisciplinary:</b> No	<b>Pending publication:</b> No
<b>Research group:</b>		<b>Additional authors:</b> 0
<b>Co-authors:</b> 1: Cain, G.D. 2: Hermanowicz, E. 3: Rojewski, M.		External author: Yes External author: Yes External author: Yes
<b>Other relevant details:</b> This paper presents the results of research, sponsored by the Polish Committee for Scientific Research and British Council, which was jointly conducted by the University of Westminster and the Technical University of Gdansk, Poland. The work provides digital solutions for wide-range estimation of instantaneous frequency.		
<b>Output number:</b> 2	<b>Output type:</b> Journal article	
<b>Title:</b> A WISE method for designing IIR filters		
<b>Journal title:</b> IEEE Transactions on Signal Processing		
<b>Month/year of publication:</b> July 2001	<b>Pagination:</b> 1421-1432	<b>Volume:</b> 49(7)
<b>ISSN:</b> 1053-587X		
<b>URL:</b> <a href="http://dx.doi.org/10.1109/78.928695">http://dx.doi.org/10.1109/78.928695</a>		
<b>DOI:</b> 10.1109/78.928695		
<b>Is duplicate:</b> No	<b>Is interdisciplinary:</b> No	<b>Pending publication:</b> No
<b>Research group:</b>		<b>Additional authors:</b> 0
<b>Co-authors:</b> 1: Cain, G.D. 2: Hermanowicz, E. 3: Rojewski, M.		External author: Yes External author: Yes External author: Yes
<b>Other relevant details:</b> This paper presents the results of research, sponsored by the Polish Committee for Scientific Research and British Council, which was jointly conducted by the University of Westminster and the Technical University of Gdansk, Poland. The work explores practical approaches of designing stable, optimal IIR filters using unconstraint optimisation techniques.		
<b>Output number:</b> 3	<b>Output type:</b> Journal article	
<b>Title:</b> Spectral analysis of randomly sampled signals: suppression of aliasing and sampler jitter		
<b>Journal title:</b> IEEE Transactions on Signal Processing		
<b>Month/year of publication:</b> December 2004	<b>Pagination:</b> 3324-3334	<b>Volume:</b> 52(12)
<b>ISSN:</b> 1053-587X		
<b>URL:</b> <a href="http://dx.doi.org/10.1109/TSP.2004.837436">http://dx.doi.org/10.1109/TSP.2004.837436</a>		
<b>DOI:</b> 10.1109/TSP.2004.837436		
<b>Is duplicate:</b> No	<b>Is interdisciplinary:</b> No	<b>Pending publication:</b> No
<b>Research group:</b>		<b>Additional authors:</b> 0
<b>Co-authors:</b> 1: Allay, N.		External author: No
<b>Other relevant details:</b> This paper presents the results of research conducted in two EC-funded projects (EURODASP and DASPTOOL). The paper proposes two techniques for spectrum estimation of heavily undersampled signals. The methodologies developed in this paper are used in a project for Rolls-Royce for estimating vibrations of compressor's blades in modern jet engines. Contact person Pete Russhard, Rolls-Royce, PO BOX 31, Moor Lane, Derby DE24 8BJ, England.		

## University of Westminster : 24 - Electrical and Electronic Engineering

### RAE 2008 : RA2 - Research outputs

**Output number:** 4

**Output type:** Journal article

**Title:**

Optimal random sampling for spectrum estimation in DASP applications

**Journal title:** International Journal of Applied Mathematics and Computer Science

**Month/year of publication:** November

**Pagination:** 463-469

**Volume:** 15(4)

2005

**ISSN:** 1641-876X

**URL:** [http://www.issi.uz.zgora.pl/amcs/index.php?main\\_page=document\\_product\\_info&cPath=63\\_103\\_107&products\\_id=583](http://www.issi.uz.zgora.pl/amcs/index.php?main_page=document_product_info&cPath=63_103_107&products_id=583)

**DOI:**

**Is duplicate:** No

**Is interdisciplinary:** No

**Pending publication:** No

**Research group:**

**Co-authors:**

**Additional authors:** 0

1: Qu, D.

External author: No

**Other relevant details:**

This paper presents the results of research conducted in two EC-funded projects (EURODASP and DASPTOOL). It generalises and explores the limits of the approaches proposed in the third output above. Although not directly applied in the project, the results of this research inform the above-mentioned work for Rolls-Royce.

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