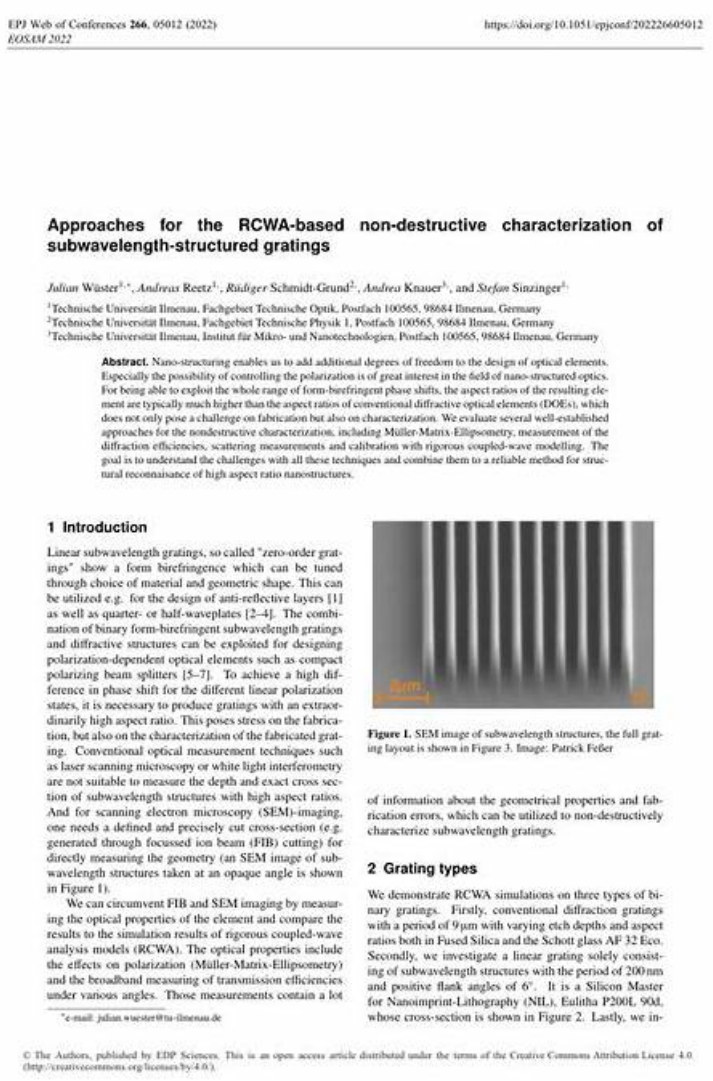
RCWA Question Explanations & Key RCWA Concepts



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Approaches for the RCWA-based non-destructive characterization of subwavelength-structured gratings

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Abstract. Nano-structuring enables us to add additional degrees of freedom to the design of optical elements. Especially the possibility of controlling the polarization is of great interest in the field of nano-structured optics. For being able to exploit the whole range of form-birefringent phase shifts, the aspect ratios of the resulting element are typically much higher than the aspect ratios of conventional diffractive optical elements (DOEs), which does not only pose a challenge on fabrication but also on characterization. We evaluate several well-established approaches for the nondestructive characterization, including Müller-Matrix-Ellipsometry, measurement of the diffraction efficiencies, scattering measurements and calibration with rigorous coupled-wave modelling. The goal is to understand the challenges with all these techniques and combine them to a reliable method for structural reconnaisance of high aspect ratio nanostructures.

1 Introduction

Linear subwavelength gratings, so called "zero-order gratings" show a form birefringence which can be tuned through choice of material and geometric shape. This can be utilized e.g. for the design of anti-reflective layers [1] as well as quarter- or half-waveplates [2–4]. The combination of binary form-birefringent subwavelength gratings and diffractive structures can be exploited for designing polarization-dependent optical elements such as compact polarizing beam splitters [5–7]. To achieve a high difference in phase shift for the different linear polarization states, it is necessary to produce gratings with an extraordinarily high aspect ratio. This poses stress on the fabrication, but also on the characterization of the fabricated grating. Conventional optical measurement techniqaes such as laser scanning microscopy or white light interferometry are not suitable to measure the depth and exact cross section of subwavelength structures with high aspect ratios. And for scanning electron microscopy (SEM)-imaging, one needs a defined and precisely cut cross-section (e.g. generated through focussed ion beam (FIB) cutting) for directly measuring the geometry (an SEM image of subwavelength structures taken at an opaque angle is shown in Figure 1).

We can circumvent FIB and SEM imaging by measuring the optical properties of the element and compare the results to the simulation results of rigorous coupled-wave analysis models (RCWA). The optical properties include the effects on polarization (Müller-Matrix-Ellipsometry) and the broadband measuring of transmission efficiencies under various angles. Those measurements contain a lot

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Figure 1. SEM image of subwavelength structures, the full grating layout is shown in Figure 3. Image: Patrick Feßer

of information about the geometrical properties and fabrication errors, which can be utilized to non-destructively characterize subwavelength gratings.

2 Grating types

We demonstrate RCWA simulations on three types of binary gratings. Firstly, conventional diffraction gratings with a period of 9 µm with varying etch depths and aspect ratios both in Fused Silica and the Schott glass AF 32 Eco. Secondly, we investigate a linear grating solely consisting of subwavelength structures with the period of 200 nm and positive flank angles of 6°. It is a Silicon Master for Nanoimprint-Lithography (NIL), Eulitha P200L 90d, whose cross-section is shown in Figure 2. Lastly, we in-

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RUCKUS RCWA Exam Syllabus Topics:

Topic	Details
Topic 1	• RUCKUS Technologies, products & solutions: This section of the exam measures skills of the Certified Logistics Technician and covers RUCKUS-specific technologies, such as proprietary Wi-Fi features, Bonjour Gateway, and automated cell sizing capabilities. It focuses on the proper selection and sizing of RUCKUS controllers (SmartZone, Unleashed, ROne • Cloud) and Access Points (APs) based on platform limitations. Furthermore, it includes knowledge of advanced features like clustering, geo-redundancy, initial IoT integration, and the necessary processes for product licensing and using RUCKUS support tools and documentation.

Topic 2	• Foundational Wi-Fi technologies, standards & concepts: This section of the exam measures skills of the Certified Logistics Associate and covers the foundational principles of Wi-Fi, including radio frequency (RF) concepts, global 802.11 standards, and frequency channelization up to the latest standards (a • b • g • n • ac • ax • BE). It assesses knowledge of antenna characteristics, the difference between Mesh and point-to-point connections, and the basics of authentication methods, including certificate usage and the high-level steps of client roaming across access points.
Topic 3	• Wi-Fi Solution Enhancement through Tuning and Optimization: This section of the exam measures skills of the Certified Logistics Technician and focuses on advanced techniques for fine-tuning and optimizing Wi-Fi network performance after deployment. It includes balancing load and frequency bands, implementing airtime fairness and decongestion methods, and using advanced 802.11 roaming amendments (k, r, v) to improve client mobility. The section also covers optimizing radio settings, such as Client Admission Control (CAC), and managing channel selection and power optimization, including the use of DFS and RUCKUS AI features.
Topic 4	• RUCKUS Wi-Fi Solution Management:This section of the exam measures skills of the Certified Logistics Associate and covers the necessary administrative and maintenance tasks for the overall solution. This includes managing system upgrade paths, defining and controlling administrator roles using directory services and Multi-Factor Authentication (MFA), monitoring network events and alarms, and performing critical functions like backup and restoration on the SmartZone controller. It also addresses generating reports, setting health thresholds, and identifying and locating rogue access points on a map.

>> RCWA Question Explanations <<

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RUCKUS Certified Wi-Fi Associate Exam Sample Questions (Q29-Q34):

NEW QUESTION # 29
Which log category in SmartZone provides details about AP join requests and firmware compatibility issues?

- A. Control Plane Log
- B. Events Log
- C. AP Manager Log
- D. System Log

Answer: C

Explanation:
TheAP Manager Logwithin SmartZone is dedicated to monitoring access point registration, join processes, firmware version checks, and heartbeat communication with the controller.
As stated in theRUCKUS One Online Help - Log Categories and Troubleshootingand theRUCKUS Analytics 3.5 User Guide - Device Connectivity Diagnostics, the AP Manager Log records messages about:
* AP registration attempts
* Join authorization success/failure
* Firmware mismatch detection and upgrade triggers
TheSystem Logcovers controller-level events, theEvents Logrecords systemwide notifications, and the Control Plane Logcaptures

traffic flow analytics.
References:
RUCKUS One Online Help - SmartZone Logging and Event Analysis
RUCKUS Analytics 3.5 User Guide - Device Join and Firmware Status Analysis RUCKUS AI Documentation - SmartZone Logging Architecture

NEW QUESTION # 30
The Background Scanning interval is increased to 90 seconds. Which three processes will take longer to update their data? (Choose three.)

- A. Auto power adjustment
- B. Spectrum analysis
- C. Connected client count
- D. Rogue AP detection
- E. Channel throughput measurement
- F. Auto-channel selection

Answer: A,D,F

Explanation:
Background Scanningin RUCKUS APs allows radios to periodically scan other channels to collect RF environment data while still serving clients. The scan interval determines how often the AP samples channel information for features likeChannelFly,Auto Cell Sizing, androgue detection.
According toRUCKUS One Online Help - Background Scanning and RF Management, andRUCKUS Analytics 3.5 User Guide - RF Monitoring, increasing theBackground Scanning intervalto90 seconds delays updates for processes that depend on real-time RF sampling, specifically:
* Rogue AP Detection (B):Takes longer to discover unauthorized or neighboring APs.
* Auto-Channel Selection (C):Updates channel quality metrics less frequently, slowing responsiveness to interference changes.
* Auto Power Adjustment (E):Depends on scanning results to optimize transmit power for coverage balance, so adjustments occur less frequently.
Processes such asclient countandthroughput measurementrely on active client data, not background scanning, andspectrum analysisoperates in a dedicated analysis mode outside of normal scanning intervals.
References:
RUCKUS One Online Help - Background Scanning Interval and RF Optimization RUCKUS Analytics 3.5 User Guide - Auto Channel and Power Adjustment Logic RUCKUS AI Documentation - Background Scanning and Rogue Detection Behavior

NEW QUESTION # 31
Which RUCKUS technology prioritizes latency-sensitive traffic and maintains QoS across both wired and wireless segments?

- A. PD-MRC
- B. SmartCast
- C. BeamFlex+
- D. ChannelFly

Answer: B

Explanation:
SmartCastis RUCKUS's patentedtraffic classification and Quality of Service (QoS)technology. It dynamically prioritizes network packets based on type, marking delay-sensitive applications such as voice or video for prioritized transmission.
PerRUCKUS One Online Help - SmartCast Traffic Prioritization, SmartCast identifies traffic categories usingDeep Packet Inspection (DPI)and applies corresponding802.1p/DSCP markingsacross wired and wireless segments.
This ensures consistent service quality for time-sensitive applications even during network congestion.
BeamFlex+,PD-MRC, andChannelFlyoperate at the RF level and do not manage traffic prioritization or QoS policies.
References:
RUCKUS One Online Help - SmartCast and Traffic Prioritization Overview
RUCKUS Analytics 3.5 User Guide - Application Performance and QoS Metrics RUCKUS AI Documentation - End-to-End QoS and Traffic Classification

NEW QUESTION # 32
Which SmartZone feature allows an administrator to schedule periodic configuration backups automatically?

- A. Configuration Archive
- B. Backup Management
- C. Cluster Maintenance Policy
- D. System Snapshot Scheduler

Answer: B

Explanation:
TheBackup Managementfeature inSmartZoneenables administrators to scheduleautomatic configuration backupsat regular intervals. These backups can include cluster, zone, and AP configuration data.
As detailed inRUCKUS One Online Help - Backup and Restore Procedures, this feature supportsmanual and scheduledbackups with options for secure off-box storage.
TheRUCKUS Analytics 3.5 User Guide - Backup Compliance Monitoringnotes that this ensures disaster recovery readiness and simplifies configuration rollback.
System SnapshotandCluster Maintenancefeatures track versioning and updates but are not used for configuration backup automation.
References:
RUCKUS One Online Help - Backup Management and Scheduling Options
RUCKUS Analytics 3.5 User Guide - Configuration and Backup Audit Reports RUCKUS AI Documentation - Backup Automation and Data Retention

NEW QUESTION # 33
Which RUCKUS feature dynamically learns client data rates and channel conditions to recommend better-performing channels for each AP?

- A. PD-MRC
- B. ChannelFly
- C. BeamFlex+
- D. SmartCast

Answer: B

Explanation:
ChannelFlyis RUCKUS's patentedmachine-learning-based dynamic channel selectionalgorithm. Unlike static or simple noise-based channel assignments, ChannelFly continuously measuresactual throughputand learns the performance potential of each available channel.
According to theRUCKUS One Online Help - ChannelFly OverviewandRUCKUS AI documentation, ChannelFly usesreal-time capacity analysisinstead of noise floor alone to choose channels that yield the highest throughput under current interference and load conditions.
BeamFlex+manages antenna patterns,SmartCasthandles QoS and traffic shaping, andPD-MRCenhances reception diversity-none perform dynamic channel learning.
References:
RUCKUS One Online Help - ChannelFly Dynamic Channel Management
RUCKUS Analytics 3.5 User Guide - RF Performance and Channel Optimization Metrics RUCKUS AI Documentation - Machine Learning in Channel Optimization

NEW QUESTION # 34
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