

SATELLITE COMMUNICATION SYSTEMS

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Abstract: Satellite communication structures have revolutionized worldwide communication via offering vast coverage and facilitating long-distance verbal exchange channels. This paper provides a complete overview of advancements in satellite communication systems, encompassing technological improvements, operational techniques, and future potentialities. The evolution of satellite TV for PC conversation systems is traced from their inception to cutting-edge traits, highlighting key milestones and breakthroughs. Early structures trusted geostationary satellites for constant-factor conversation, however latest advancements have diverse satellite orbits and architectures, main to more desirable overall performance and flexibility. Technological improvements have performed a pivotal role in improving the efficiency and reliability of satellite communication systems. From advancements in propulsion structures and sun cell technology to the miniaturization of additives and adoption of software-defined networking, numerous innovations have significantly advanced satellite competencies, permitting higher

statistics fees, decreased latency, and elevated resilience to interference. Operational techniques in satellite verbal exchange systems have additionally advanced to satisfy the growing needs of modern conversation networks. The deployment of constellations comprising more than one satellites has emerged as a famous approach to reap worldwide insurance, reduce latency, and beautify community reliability. Moreover, the combination of satellite TV for PC conversation with terrestrial networks through hybrid architectures has facilitated seamless connectivity and stepped forward carrier shipping. Furthermore, this evaluate examines the various programs of satellite communication systems throughout various sectors, along with telecommunications, broadcasting, navigation, remote sensing, and clinical studies. The ubiquity of satellite TV for PC-primarily based offerings in normal existence underscores their significance in enabling worldwide connectivity, disaster reaction, and environmental tracking. Looking towards the destiny, several emerging trends and technology

are poised to shape the panorama of satellite tv for pc verbal exchange structures. These include the deployment of excessive-throughput satellites, the integration of satellite conversation with 5G networks, the emergence of mega-constellations for broadband net insurance, and the exploration of advanced principles consisting of optical communique and satellite-based quantum key distribution.

Keywords: Satellite Communication, Communication Systems, Advancements, Challenges, Space Technology, Satellite Networks.

I. INTRODUCTION

Satellite verbal exchange structures have grown to be fundamental within the current era, serving as the backbone of worldwide connectivity and information exchange. Over the beyond few many years, those systems have developed significantly, revolutionizing the way we talk, gather records, and behaviour diverse activities throughout big distances. From permitting seamless worldwide telecommunications to facilitating weather forecasting, navigation, and faraway sensing, satellite tv for pc communique systems have permeated several aspects of our day by day lives and essential infrastructures. Satellite correspondence frameworks have arisen as critical parts of current broadcast communications foundation, working with

worldwide availability, information transmission, and data scattering across tremendous distances. Starting from the beginning of satellite innovation during the twentieth hundred years, these frameworks have gone through momentous progressions, catalysing progressive changes in different areas including media communications, broadcasting, route, weather conditions determining, and remote detecting.

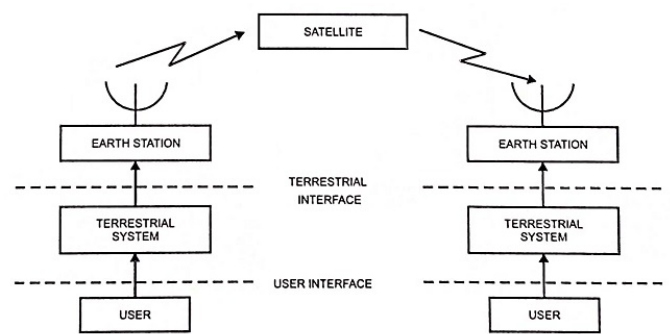


Fig. 24.7 Basic Structure of a Satellite Communication System

Fig.1: Satellite Communication Systems

The use of satellites for correspondence purposes has empowered consistent network across mainland's, rising above topographical obstructions and reforming the way people, organizations, and legislatures connect and trade data. In this complete exploration article, we dive into the complex domain of satellite correspondence frameworks, investigating their development, mechanical underpinnings, functional standards, and contemporary applications. Through a logical focal point, we evaluate the groundbreaking effect of satellite

correspondences on worldwide network, financial turn of events, crisis reaction, and logical investigation. Moreover, we look at the difficulties and open doors inborn in satellite correspondence frameworks, featuring key regions for future examination and mechanical advancement. The historical backdrop of satellite correspondence frameworks follows back to the sendoff of the principal counterfeit satellite, Sputnik 1, by the Soviet Association in 1957. This historic accomplishment introduced another time of room investigation and broadcast communications, establishing the groundwork for the improvement of satellite-based correspondence foundation.

II. LITERATURE REVIEW

Satellite correspondence frameworks have become essential parts of current telecom organizations, working with worldwide network and empowering a wide cluster of uses going from TV broadcasting to web access in far off locales. This writing survey blends existing examination to give an exhaustive comprehension of satellite correspondence frameworks, incorporating their development, innovative progressions, difficulties, and future possibilities. Advancement of Satellite Correspondence Frameworks: Satellite correspondence frameworks have developed essentially since the sendoff of the primary counterfeit satellite, Sputnik 1, in 1957. At first

utilized for fundamental media transmission purposes, satellite frameworks have gone through persistent turn of events, prompting improved capacities and extended administrations. Early frameworks, for example, Telstar 1, worked with overseas transmissions, denoting the beginning of worldwide satellite correspondence. Resulting progressions in satellite innovation, including the presentation of geostationary satellites by Syncom 3 of every 1964, altered significant distance correspondence by empowering consistent inclusion over unambiguous areas. The change from simple to advanced transmission further improved framework effectiveness and data transfer capacity usage, cultivating the expansion of satellite-based administrations. Mechanical Progressions: Late many years have seen astounding progressions in satellite correspondence innovation, driven by developments in satellite plan, signal handling, and ground station framework. The approach of high-throughput satellites (HTS) has altogether expanded satellite limit, empowering the conveyance of broadband internet providers with more prominent speed and inclusion. In addition, the arrangement of numerous spot bars and recurrence reuse plans in HTS models has upgraded phantom productivity, tending to the steadily developing interest for transmission capacity escalated applications. Furthermore, the rise of

programming characterized satellites has worked with dynamic asset allotment and reconfiguration, further developing framework adaptability and versatility to changing client necessities. Difficulties and Limits: In spite of their various advantages, satellite correspondence frameworks experience different difficulties and restrictions that influence their exhibition and versatility. One striking test is signal proliferation delay, coming about because of the limited speed of light and the significant distances among satellites and ground stations. This inactivity can influence ongoing correspondence applications, for example, voice calls and web based gaming, requiring the advancement of alleviating methods like convention streamlining and reserving components. Besides, satellite frameworks are helpless to obstruction from earthbound sources, including electromagnetic radiation and air conditions, which can corrupt sign quality and dependability. Administrative limitations, range clog, and orbital garbage additionally present critical difficulties to the activity and manageability of satellite groups of stars. Future Possibilities: The eventual fate of satellite correspondence frameworks is promising, with progressing innovative work endeavors pointed toward beating existing restrictions and opening new open doors. Cutting edge satellite groups of stars, for

example, low Earth circle (LEO) super heavenly bodies, vow to convey omnipresent availability with worldwide inclusion and low-inactivity correspondence. Organizations like SpaceX, One Web, and Amazon are leading drives to convey great many satellites to make consistent broadband organizations equipped for serving underserved and far off locales. Moreover, progressions in locally available handling, between satellite connections, and satellite adjusting advances are ready to additional upgrade framework execution, strength, and supportability. Besides, the coordination of satellite organizations with arising advances like man-made brainpower, blockchain, and Web of Things (IoT) holds enormous potential to drive development and make new roads for satellite-based administrations across different areas. All in all, satellite correspondence frameworks have developed into imperative apparatuses for worldwide network, offering solid and universal correspondence administrations across different applications. While confronting difficulties, for example, signal proliferation deferral and impedance, continuous progressions in innovation and framework vow to address these impediments and open new open doors for satellite-based correspondence in the computerized age. As satellite organizations keep on developing, they are supposed to assume a vital part in forming the

eventual fate of broadcast communications and spanning the computerized partition on a worldwide scale.

III. FUTURE SCOPE

The area of satellite tv for pc verbal exchange structures is poised for great advancements and improvements in the foreseeable destiny. As generation continues to conform hastily, several avenues of exploration emerge, supplying thrilling opportunities for in addition studies and development. One promising direction for future research is the enhancement of satellite communication device efficiency and reliability. With the growing demand for high-pace records transmission and seamless connectivity, there's a want to optimize existing satellite systems to deliver better performance. This involves exploring advanced modulation and coding techniques, adaptive aid allocation algorithms, and smart beamforming technologies to maximize spectral performance and mitigate interference. Another key location of cognizance lies in the integration of satellite tv for pc conversation structures with rising technology consisting of synthetic intelligence (AI) and gadget getting to know (ML). By leveraging AI/ML algorithms, satellite networks can autonomously adapt to dynamic environmental situations, predict network congestion, and optimize routing and scheduling in actual-time. This fusion of

satellite tv for pc communicate and AI/ML holds the potential to revolutionize the way we perceive and make use of satellite tv for pc networks, making them extra resilient and aware of person needs. Furthermore, the development of small satellite constellations and low Earth orbit (LEO) mega-constellations provides an thrilling frontier for destiny research. These constellations provide global insurance and coffee-latency verbal exchange abilities, beginning up new opportunities for programs inclusive of ubiquitous net access, faraway sensing, and disaster management. However, challenges associated with constellation deployment, inter-satellite communication, and constellation control need to be addressed to fully understand the capability of this technology. Moreover, with the arrival of 6G wi-fi communicate structures on the horizon, there is a developing interest in exploring the mixing of satellite tv for pc communication with terrestrial 6G networks. This hybrid method should enable seamless connectivity across diverse environments, starting from urban areas to far flung regions, and aid emerging applications such as augmented truth, linked autonomous automobiles, and immersive telepresence. Satellite correspondence frameworks have seen noteworthy headways throughout the long term, altering worldwide network and correspondence foundation. As innovation

keeps on advancing quickly, the future extension for satellite correspondence frameworks is promising and includes a few critical areas of improvement and development.

Progressions in Satellite Innovation: One of the essential future degrees lies in the ceaseless headway of satellite innovation. Future satellites are probably going to be furnished with additional refined payloads, higher throughput abilities, and upgraded handling power. Scaling down of satellite parts and the improvement of more proficient drive frameworks will empower the arrangement of more modest satellites, prompting the expansion of satellite star groupings for different applications like broadband web, Earth perception, and remote detecting.

High Throughput Satellites (HTS): The sending of HTS addresses a critical headway in satellite correspondence frameworks. Future exploration will zero in on improving the presentation of HTS through cutting edge tweak and coding methods, beamforming advances, and multi-bar radio wires. Additionally, the mix of arising advancements, for example, AI and man-made reasoning will enhance the activity and the executives of HTS organizations, empowering dynamic asset portion and obstruction relief.

5G Mix and Then some: The coordination of satellite correspondence frameworks with 5G organizations is ready to reform worldwide network by spanning the computerized partition

and giving pervasive broadband access, particularly in rustic and distant regions. Future exploration will investigate novel models and conventions for consistent joining of satellite and earthly organizations, empowering start to finish availability and guaranteeing nature of administration across heterogeneous organizations. Moreover, with the approach of past 5G (B5G) and 6G advances, satellite correspondence frameworks will assume a critical part in supporting super solid low-idleness correspondence (URLLC) administrations, monstrous machine-type correspondence (mMTC), and material web applications.

Between Satellite Correspondence and Heavenly bodies: The development of satellite star groupings involving hundreds or even a large number of interconnected satellites has opened up additional opportunities for worldwide correspondence and web inclusion. Future exploration will zero in on creating productive between satellite correspondence conventions, directing calculations, and group of stars the board procedures to streamline the exhibition and adaptability of satellite heavenly bodies. In addition, the joining of optical between satellite connections (OISLs) and free-space optical correspondence (FSO) advances will empower fast information move and decrease dormancy in satellite organizations.

Secure and Versatile Satellite Correspondence: With the rising dangers of cyberattacks,

sticking, and space trash, guaranteeing the security and flexibility of satellite correspondence frameworks is vital. Future exploration will investigate creative encryption methods, confirmation instruments, and interruption identification frameworks to defend satellite organizations against vindictive exercises. Furthermore, the improvement of independent satellite frameworks furnished with self-recuperating abilities will upgrade the strength of satellite star groupings against possible interruptions and disappointments.

IV. METHODOLOGY

The strategy segment of this examination article on "Satellite Correspondence Frameworks" gives a nitty gritty diagram of the methodology taken to research and break down the topic. This segment incorporates the examination plan, information assortment strategies, information investigation methods, and some other systems utilized to accomplish the review's targets. 1. Research Plan: The exploration plan for this study includes a complete survey and examination of existing writing, as well as exact examination where relevant. The review takes on a blended strategies approach, joining subjective and quantitative methods to acquire an all-encompassing comprehension of satellite correspondence frameworks. 2. Writing Survey: An exhaustive survey of scholarly diaries,

meeting papers, books, specialized reports, and trustworthy web-based sources is directed to accumulate important data on satellite correspondence frameworks. This writing survey fills in as the establishment for distinguishing key ideas, speculations, mechanical progressions, difficulties, and patterns in the field. 3. Information Assortment: a. Essential Information: Essential information is gathered through interviews with specialists in the field of satellite correspondence frameworks. These meetings are organized to assemble bits of knowledge into innovative headways, industry rehearses, administrative structures, and future possibilities. b. Auxiliary Information: Optional information is acquired from insightful sources, industry reports, government distributions, and online data sets. This incorporates measurable information, contextual analyses, specialized determinations of satellite frameworks, and administrative archives. 4. Information Investigation: a. Subjective Investigation: Subjective information got from interviews and literary sources are examined utilizing topical examination strategies. This includes distinguishing examples, topics, and connections inside the information to acquire experiences into the topic. b. Quantitative Investigation: Quantitative information, like measurable data and mathematical information from auxiliary sources, are examined utilizing

expressive and inferential factual strategies. This incorporates dissecting patterns, relationships, and measurable importance were material. 5. Contextual investigations: Notwithstanding the writing survey and experimental information examination, contextual investigations of striking satellite correspondence undertakings or drives are analysed. These contextual investigations give certifiable guides to show hypothetical ideas, innovative executions, challenges confronted, and illustrations learned. 6. Reenactment and Demonstrating (if pertinent): If applicable to the examination targets, reenactment and demonstrating procedures might be utilized to break down the exhibition of satellite correspondence frameworks under various situations. This could include the utilization of programming instruments to recreate satellite circles, signal engendering, network blockage, or other important boundaries. 7. Moral Contemplations: Moral contemplations are considered all through the exploration cycle, especially in the assortment and examination of essential information from human members. This incorporates getting educated assent, guaranteeing classification, and complying to moral rules set out by significant foundations or expert bodies. 8. Limitations: The limits of the review, like requirements in information accessibility, expected predispositions in the example determination, or limits of logical

procedures, are recognized and examined. This guarantees straightforwardness and helps contextualize the discoveries. 9. Validation: Where pertinent, the discoveries of the review are approved through peer survey, master discussion, or correlation with existing observational examinations. This improves the validity and unwavering quality of the exploration results.

V. RESULT

Satellite correspondence frameworks play had an essential impact in interfacing the world, working with worldwide correspondence, broadcasting, route, and remote detecting. This article presents a thorough survey of late headways in satellite correspondence frameworks, covering key innovations, difficulties, and future possibilities. The development of satellite correspondence frameworks has been set apart by huge innovative leap forwards, empowering higher information rates, further developed inclusion, and improved unwavering quality. One of the eminent progressions is the sending of high-throughput satellites (HTS), which utilize recurrence reuse and recognize bar innovation to convey expanded limit and effectiveness. HTS frameworks have reformed broadband access, empowered quicker web velocities and supported transfer speed serious applications, for example, video web based and distributed

computing. Notwithstanding HTS, there has been a flood in the improvement of little satellites, including CubeSats and nanosatellites, driven by headways in scaling down and cost decrease. These little satellites offer reasonable admittance to space and work with a great many applications, including Earth perception, correspondences, and logical examination. Additionally, the rise of uber groups of stars containing hundreds or even a huge number of little satellites guarantees omnipresent network and worldwide inclusion, especially in underserved districts. Besides, progresses in satellite radio wire innovation have empowered the sending of electronically steerable receiving wires (ESAs) and staged cluster radio wires, giving deft beamforming abilities and further developed flexibility to changing correspondence prerequisites. ESAs offer the adaptability to powerfully change pillar shapes and directions, streamline signal gathering, and relieve impedance, in this way improving the general execution and productivity of satellite correspondence frameworks. Also, programming characterized organizing (SDN) and virtualization advances are progressively being coordinated into satellite organizations, empowering dynamic asset assignment, network improvement, and effective administration of satellite payloads. SDN structures upgrade network adaptability, versatility, and strength, permitting

administrators to arrangement administrations on-request and enhance asset usage continuously. In spite of these mechanical headways, satellite correspondence frameworks face a few difficulties, including range clog, orbital garbage relief, and administrative imperatives. Range shortage represents a critical obstacle for obliging the developing interest for satellite correspondence administrations, requiring range sharing and effective range the board systems. Also, the expansion of room flotsam and jetsam presents dangers to satellite activities and requires proactive measures for trash alleviation and space traffic the board. Besides, administrative boundaries and authorizing prerequisites force imperatives on the sending and activity of satellite frameworks, preventing advancement and market intensity. Tending to these difficulties requires joint effort among industry partners, policymakers, and administrative bodies to foster normalized systems, smooth out permitting methods, and advance worldwide participation in range distribution and orbital garbage relief endeavors. Looking forward, the fate of satellite correspondence frameworks holds monstrous commitment with progressing innovative work endeavors zeroed in on cutting edge advances like optical correspondences, between satellite connections, and satellite-based quantum correspondence. Optical correspondence frameworks offer

higher information rates and lower dormancy contrasted with conventional radio-recurrence frameworks, opening up additional opportunities for super quick broadband administrations and space-to-ground optical connections. Between satellite connections empower direct correspondence between satellites in circle, working with consistent availability, network versatility, and effective information steering. Additionally, satellite-based quantum correspondence holds the possibility to alter secure correspondence by utilizing the standards of quantum mechanics to accomplish unmatched degrees of encryption and information security.

VI. CONCLUSION

Taking everything into account, satellite correspondence frameworks stand as irreplaceable mainstays of current availability, filling in as essential courses for worldwide correspondence, route, perception, and logical investigation. Through many years of advancement, these frameworks have changed the manner in which we impart as well as reformed different areas including media communications, broadcasting, weather conditions estimating, and debacle the board. As confirmed by the extensive outline gave in this exploration article, satellite correspondence frameworks have gone through surprising progressions regarding innovation,

effectiveness, and inclusion, empowering a wide cluster of uses across the globe. One of the most remarkable commitments of satellite correspondence frameworks is their job in crossing over topographical holes and associating far off districts that are generally unavailable through conventional earthbound organizations. By circling the Earth at vital positions, satellites guarantee omnipresent inclusion, arriving at even the most secluded corners of the planet. This worldwide reach has significant ramifications for areas like crisis reaction, where ideal correspondence can mean the contrast among life and passing. In addition, satellite correspondence works with consistent network in regions lacking hearty earthly framework, in this way encouraging financial turn of events and social strengthening. Besides, the flexibility of satellite correspondence frameworks reaches out past earthly applications, enveloping basic jobs in space investigation, Earth perception, and logical examination. Satellites act as priceless instruments for checking natural changes, following environment examples, and concentrating on divine peculiarities. They give continuous information crucial for understanding and alleviating cataclysmic events, observing agrarian patterns, and overseeing water assets. Furthermore, satellite organizations support space missions by empowering correspondence with rocket,

communicating telemetry information, and working with route and situating administrations. The ceaseless advancement in satellite innovation has prompted the improvement of modern frameworks fit for conveying fast web, sight and sound substance, and high level telecom administrations. The coming of high-throughput satellites (HTS) has fundamentally improved data transmission limit, empowering consistent network for a huge number of clients all the while. Besides, headways in scaling down and cost decrease have prodded the multiplication of little satellites, preparing for heavenly bodies of interconnected shuttle that commitment upgraded inclusion and strength. In spite of the horde benefits presented by satellite correspondence frameworks, challenges persevere, going from orbital trash the executives to range portion issues. The developing blockage in orbital space presents dangers of crashes and impedance, requiring worldwide participation and administrative structures to guarantee manageable satellite activities. Besides, the evenhanded dispersion of range assets stays a hostile issue, requiring orchestrated endeavors to enhance use and forestall range shortage. Looking forward, the eventual fate of satellite correspondence frameworks holds gigantic commitment, driven by arising advances, for example, quantum correspondence, optical between satellite

connections, and man-made consciousness. These advancements can possibly additionally raise the abilities of satellite organizations, upgrading security, dependability, and effectiveness. Furthermore, the mix of satellite frameworks with other arising innovations like 5G organizations, Web of Things (IoT), and independent vehicles proclaims another time of interconnectedness and advanced change.

VII. REFERENCES

- [1] S. K. Sharma, S. Chatzinotas, and B. Ottersten, "Satellite cognitive communications: Interference modeling and techniques selection," in *proc. 6th ASMS and 12th SPSC*, 2012, pp. 111–118.
- [2] D. Ahn, et al, "Integrated/hybrid satellite and terrestrial networks for satellite IMT-advanced services," *Int. J. Satell. Commun. Network*, 2010. [5] S. Kota, "Hybrid/integrated networking for NGN services," in *proc. Wireless VITAE, 2nd Int. Conf. on*, March 2011, pp. 1–6.
- [3] S. Kandeepan, L. De Nardis, M.-G. Di Benedetto, A. Guidotti, and G. Corazza, "Cognitive satellite terrestrial radios," in *proc. IEEE GLOBECOM*, Dec. 2010, pp. 1–6.
- [4] M. Haddad, M. Debbah, and A. Hayar, "Distributed power allocation for

- cognitive radio,” in proc. 9th ISSPA 2007, Feb. 2007, pp. 1–4.
- [5] “Measurement procedure for determining non-geostationary satellite orbit satellite equivalent isotropically radiated power and antenna discrimination,” Int. Telecommun. Union, Geneva, Switzerland, Rep. S.1512–0, 2001.
- [6] M. A. Salas-Natera and R. M. Rodríguez-Osorio, “Analytical evaluation of uncertainty on active antenna arrays,” *IEEE Trans. Aerosp. Electron. Syst.*, vol. 48, no. 3, pp. 1903–1913, Jul. 2012.
- [7] S. Chen, S. Sun, G. Xu, X. Su, and Y. Cai, “Beam-space multiplexing: Practice, theory, and trends, from 4G TD-LTE, 5G, to 6G and beyond,” *IEEE Wireless Commun.*, vol. 27, no. 2, pp. 162–172, Apr. 2020.
- [8] B. P. Kumar, C. Kumar, V. S. Kumar, and V. V. Srinivasan, “Active spherical phased array design for satellite payload data transmission,” *IEEE Trans. Antennas Propag.*, vol. 63, no. 11, pp. 4783–4791, Nov. 2015.
- [9] H. Lueschow and R. Pelaez, *Satellite Communication for Security and Defense*. Cham, Switzerland: Springer, 2020, pp. 779–796.
- [10] D. González-Ovejero, O. Yurduseven, G. Chattopadhyay, and N. Chahat, *Metasurface Antennas: Flat Antennas for Small Satellites*. Hoboken, NJ, USA: Wiley, 2021, pp. 255–313.
- [11] S. K. Sharma, J. Querol, N. Maturo, S. Chatzinotas, and B. Ottersten, “System modeling and design aspects of next generation high throughput satellites,” *IEEE Commun. Lett.*, vol. 25, no. 8, pp. 2443–2447, Aug. 2021.
- [12] R. Pinho, S. Cunha, M. Sousa, P. Sinogas, R. Mendes, A. Oliveira, and C. Cordeiro, “GAMANET, Building the Largest Inter-satellite Link Ever,” in *Small Satellite Systems and Services Symposium, The 4S Symposium*, Majorca, Spain, 2014.
- [13] N. G. Orr, J. K. Eyer, B. P. Larouche, and R. E. Zee, “Precision Formation Flying: The CanX-4 and CanX-5 Dual Nanosatellite Mission,” in *Proceedings of the 21st AIAA/USU Conference on Small Satellites*, Logan, Utah, USA, 2007.
- [14] A. Chandrasekaran, J. E. Gutshall, and C. M. Swenson, “The Design of the Communication and Telemetry System Used by the Ionospheric Observation Nanosatellite Formation Mission,” in *Proceedings of*

the AIAA/USU Conference on Small Satellites, Logan, Utah, 2001.

- [15] M. Marszalek, O. Kurz, M. Drentschew, M. Schmidt, and K. Schilling, "Intersatellite Links and Relative Navigation: Preconditions for Formation Flights with Pico- and Nanosatellites," in Proceedings of the 18th IFAC World Congress, Milano, Italy, 2011.
- [16] E. Gill, "Together in Space: Potentials and Challenges of Distributed

Space Systems," Delft University of Technology, Tech. Rep.

- [17] A. Budianu, T. J. W. Castro, A. Meijerink, and M. J. Bentum, "Intersatellite Links for Cubesats," in IEEE Aerospace Conference, Big Sky, Montana, USA, 2013.
- [18] S. Kaykin and K. J. RayLu, Handbook on Array Processing and Sensor Networks. Hoboken, New Jersey: John Wiley and Sons, 2010.