APPLICATIONS OF THE TRAJECTORY SOLID ANGLE (TSA) AND THE WONG'S ANGLES (WA) TO SOLVE PROBLEMS OF THAAD FOR BMDO AND FOR FUTURE MISSIONS OF NASA

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Abstract

Based on the SRC-BMDO proposal; the SRC-NASA proposals; the CHALLENGES AND CONCLUSIONS FROM PAPERS IAF-00-J.1.10 AND IAF-00-S.6.03 by the authors, two specific numerical examples are provided and presented in this paper to demonstrate what and how to solve the problems for THAAD and for the most recent mission of the Space Shuttle Atlantis to chase and to deliver the U.S. Destiny Laboratory to the International Space Station (ISS).

According to the law of patent rights together with the above proposals and published papers, the inventor of the (TSA) and (WA) patents and the authors of the papers are ready to claim:

The invention of a new directional antenna con-current to a point. This special antenna is a device with three arms each of which is designed mechanically and electronically pointing at any three ground stations with high precision at the same time automatically such that the three antenna angles which are associated with the Wong's Angles (WA) can be continously measured and input to the Digital Sensing Process (DSP).

The new directional antenna can be mounted on all the space vehicles including but not limiting to: Space Shuttles; Satellites; Airplanes; Space Planes and on all Ground Tracking Stations for the purpose of surveying; navigating and controlling of their own positioning and flying trajectories. These also include the same applications for designing underwater directional sonar antenna for the same purposes.

SRC-BMDO Proposal

A proposal entitled " Applications of the Trajectory Solid Angle (TSA) and the Wong's Angles (WA) to solve problems of THAAD" was submitted to BMDO on November 1, 1997.

SRC-NASA Proposals

In addition to the SRC-BMDO proposal, there have been three other proposals having been submitted to NASA for support:

(9) SRC-NASA proposal No. AIST-0042-0006 entitled " Applications of Trajectory Solid Angle and the Wong's Angles to support ESTO Programs: AIST,ATI, IIP, and HPCC/ESS. " January 22, 2000
(10) SRC-NASA proposal No. TRIANA-0003-0006 entitled " Applications of the Trajectory Solid Angle and the Wong's Angles for TRIANA." July 22, 1998
(11) SRC-NASA proposal No. NRA-96-HEDS-03-076 entitled " Applications of Trajectory Solid Angle and the Wong's Angles to solve fundamental problems in physics " March 21, 1997

The SRC-NASA proposal No. NRA-96-HEDS-03-076 contains a Statement of Work of 33 tasks involving in Theory and Analysis; Development of Computer Programs and Data Analysis ; Experimental Work to Confirm the New Theory and their Data Analysis. Immediate work proposed in experiment is indicated on page No. 5 of the

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proposal on Ramsey Fringe Width Measurements. The figure 2 is a sketch of a cold -atom atomic fountain clock about the parabolic trajectory of launched atoms shown from page 123 of NASA Document No. D-13845 (1966) is directly related to the PDF (Probability Density Function) which are shown in the TSA Patent 5,084,232 figure No.3 and No.4 as the supporting document for the review of the proposal. Many significant points are covered in the attached U.S. Patent 5,084.232 and the AIAA-96-1047-CP paper. There should be no confusing of the Wong's Angles (WA) and the Trajectory Solid Angle (TSA). (TSA) provides the precise definition of the probability functions for targeting problems in theory. The Wong's Angles (WA) provides a precise method to determine the real trajectories of any objects under the action of many force fields and to guide the using of the appropriate instruments for measurements in experiments. Putting both the (TSA) and the (WA) together, it will provide a complete solution of the targeting problem for BMDO. Both (TSA) and (WA) are not hypothesis. They are obtained by means of precise mathematical proof. They are mathematically correct and are proposed to confirm by experimental tests both on-ground and on-flight tests for all proposed 33 tasks listed from proposal page 8-11.

SUMMARY OF RESULTS FOR AN EXAMPLE OF THAAD

Given three ground stations identified as stations A, B, and C. Station A is at the West of Station B. Station C is at the North of Station B. Segment AB which is underneath the earth surface =0.4 R

(R= Radius of the earth at sea level = OR , where O is the center of the earth). Segment BC which is also underneath the earth surface = 0.3 R

A high altitude object is observed with two sets of Wong's Angles from Stations A, and B as

Alpha 1 = 30 degrees Beta 1 = 60 degrees Gamma 1 = 60 degrees at time t=t1 at point P1

Alpha 2 = 60 degrees Beta 2 = 30 degrees Gamma 2 = 90 degrees at time t=t2 at point P2

The Antenna Angles at point P1 can be obtained:

Angle BP1C=79.10660535 degrees; Angle BP1A= 90 degrees; Angle AP1C=109.1066054 degrees

The Antenna Angles at point P2 can also be obtained:

Angle BP2A = 90 degrees; Angle BP2C = 40.89339465 degrees ; Angle AP2C = 90 degrees

The perpendicular segment from point P1 to the point H1 on the Triangle ABC =P1H1= 0.1414213562 R

The perpendicular segment from point P2 to the point H2 on the Triangle ABC =P2H2=0.1732050808 R

The length of the segment connected between P1 and P2 = P1P2= 0.2258543893 R

The perpendicular segment from the center of the globe at point O to the point H on the Triangle ABC=OH=0.9682458366 R

The Central Angle AOB= 23.07391807 degrees; The Central Angle AOC=28.95502437 degrees

The Central Angle BOC =17.25385312 degrees.

The Arc length AB =0.4027158406 R; The Arc length BC=0.3011365456 R;

The Arc length AC=0.5053605103 R

The distance from point P1 to the center of the earth = OP1=1.11528529 R at time t = t1

The distance from point P2 to the center of the earth = OP2 =1.15559949 R at time t =t2

Therefore the true altitude of P1 = h1=OP1-R=0.11528529 R at time t = t1

And that the true altitude of P2 = h2= OP2-R=0.15559949 R at time t = t2

Please note that points H, H1 and H2 on the Triangle ABC are three different distinctive points. Segment HH1=0.1118033989 R; HH2=0.1802775638 R; H1H2=0.2236867977 R

The area of the Triangle HH1H2 =0.0099988777 R^2
The spherical surface area ABC=0.0619480055 R^2
The Surface Arc Angle CAB =A= 37.76124393 degrees
The Surface Arc Angle ABC =B=91.77467765 degrees
The Surface Arc Angle BCA = C=54.01343290 degrees
Please note that the angle A of the flat triangle ABC = Arc Sin (.6)=36.86989765 degrees
The Angle C of the flat triangle ABC = Arc Sin (.8) = 53.13010235 degrees
The Angle B of the flat triangle ABC = 90 degrees.

SUMMARY OF RESULTS TO OBTAIN THE TRAJECTORY EQUATION OF THE INTERNATIONAL SPACE STATION FROM NASA-MSFC OBSERVED DATA

24 Jan. 2001 UTC time Latitude(Degrees) Longitude(Degrees) Altitude(km)

Time	03:42	04:12	04:42
Lat.	-0.1	44.1	40.4
Long.	97.9	-139.7	-55.3
Alt.	365.3	374.3	357.3

Based on these data from MSFC, the following results can be obtained:
(1) The equation of the orbital plane containing these three points by the ISS can be obtained as
-20.0304498X -1.25685954Y +14.475414Z = 10^4 (X,Y,Z measured by km)
(2) The above orbital plane makes an angle of inclination with the earth's equator at 54.1996398 degrees
(3) The visual cone angle at the ISS to view the earth is 142.0924605 degrees.
(4) The spherical surface area on the earth being seen from ISS covers an area of 13,858,005.55 squared km. encircled by a circular circumference of 13016.29174km.
(5) The averaged altitude of the ISS h=365.6 km.
(6) The averaged velocity of the ISS is 7.688661704 km./second
(7) The averaged angular velocity of the ISS = .0011411382 radian/second
(8) The period for this orbit T =5,510.9 seconds=91.85 minutes=1.53 hours
(9) Therefore, the orbital equation can be obtained as :
X=6,743.63 Cos(Latitude+0.1) Cos(Longitude - 97.9) or
=6,743.63 Cos 360(t/T+ 0.1/360) Cos 360(t/T - 97.9/360)
Y=6,743.63 Cos(Latitude + 0.1) Sin(Longitude - 97.9) or
=6,743.63 Cos 360 (t/T + 0.1/360) Sin 360 (t/T - 97.9/360)
Z=6,743.63 Sin (Latitude + 0.1) or
=6,743.63 Sin 360 (t/T + 0.1/360)
where T = 91.85 minutes
and t is anytime after t= - (0.1/360) T

Prior Presentation Experiences : References

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