An Early Preview of

Blazing Gyros - The Movie

A Strapdown Associates production based on

The Paul G. Savage 2013 article (web-posted at www.strapdownassociates.com)

"Blazing Gyros - The Evolution of Strapdown Inertial Navigation for Aircraft"

And

Drew's Script-O-Rama (www.script-o-rama.com) web-posted dialogue from

The 1953 Paramount Pictures Corporation motion picture: ***Shane***

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The Story

Wayne is an aging strapdown inertial navigation system design engineer, with a mysterious past reputation of successfully beating strapdown design challenges using politically incorrect computation algorithms (direction cosines instead of quaternions, Kalman filters without UD factorization, attitude algorithms without orthogonalization/normalization). Weary of arguing with program managers over development schedules, battling editors over technical journal standards, and answering algorithm challengers in emotionally charged technical showdowns, Wayne retires from strapdown life, seeking refuge in Jackson Hole, Wyoming where he finds employment as a math teacher in the local high school. Wayne has his strapdown algorithms stored in a laptop computer which he has wrapped in a towel and hidden in the back of his desk drawer. Joey Starrett, a student in Wayne's class at the high school with an enthusiastic interest in strapdown inertial navigation algorithm design, idolizes Wayne.

Act 4, Scene 2

Joey is waiting for his mother to pick him up at school and sees Wayne grading test papers. Joey approaches Wayne.

Joey - You want me to tell you something?

Wayne - If you want to.

- I saw your computer in there, one day. I took a look at it.

- Oh?

- Are you mad?

- No, I guess not. But if I were you, I'd leave that thing alone.

- I wrapped it up in the towel again.

- That's a good boy.

- Could I see it again? You promised you'd show me how to write strapdown algorithms. Please!

- All right, Joey. Come on. (Wayne sees that Joey's tablet computer is with him) - Start it up!

(Wayne looks at Joey's tablet)

- We've got some learning to do! Come on. Put your cursor right here. All right, now scroll down the side. Your iteration rates are too low. Never have your algorithms running that slow. Let's fix this. Always run the high speed algorithms here so it's fast enough to measure vibration induced true coning/sculling, but no faster. Then run the low speed algorithms here so they will maintain small rotation and velocity translation vector magnitudes under maximum rotation rate conditions. That way you will protect the linearization approximation in the coning/sculling algorithms, and the overall attitude/velocity solution will accurately clear maximum rate and high frequency coning/sculling true inputs without measuring potential sensor error induced pseudo-coning/sculling at higher frequencies. Now run it, fast enough but not too slow. That's it.

- Gosh! Is that what real strapdown algorithm writers do?

- No, Joey. Most of them have tricks of their own. One for instance uses truncated attitude algorithms with normalization/orthogonalization routines to compensate the truncation errors. Another one uses ultra high-speed updating with simpler less sophisticated algorithms. And there are some who like different algorithms for different applications. But one's all you need if you can use it. Good for navigating anything to where you want it.

- What is the best way?

- What I'm telling you is as good as any, better than most.

- Let me see you run your algorithms.

(Wayne fires up his laptop)

- What do you want me to run them against? (Showing Joey his laptop)

(Joey points to something on Wayne's laptop screen)

- The simulator/sensor-driver over there, see? (Pointing to The Spin_Rock_Size simulator)

(Wayne runs it in the spin-only mode using 4-sample Taylor series time-expansion coning/sculling algorithms at 1 KHz and exact attitude, velocity, position updating algorithms at 100 Hz. When the run completes there is an exact match between the simulator output and Wayne's algorithm solution.)

- Gosh, almighty, that is good!

- You see, Joey? Now look. Remember. If you run the low-speed part fast enough and the high-speed part not too fast, you will clear low frequency rate/acceleration inputs and high frequency vibration induced true coning/sculling, but won't measure potential sensor induced high frequency pseudo coning/sculling error.

(Joey's mother arrives to pick him up and overhears the conversation)

- Wayne…

- Hello, Mrs. Starrett. I was teaching Joey a little strapdown algorithm writing.

- I don't want...

- You ought to see Wayne run his algorithms Ma. He's teaching me.

- Yes, I know. Wait for me in the car Joey.

- Oh, Ma!

(Mrs. Starrett talks to Wayne)

- Wayne, I've heard that strapdown algorithms have caused severe disagreements among software designers at sacrifice of overall software integrity. Perfectly good software has been utterly ruined by overzealous algorithm designers. Strapdown algorithms aren't going to be my boy's life !

- Why do you always have to spoil everything Ma?

(Wayne replies slowly and seriously to Mrs. Starrett)

- A strapdown algorithm is a tool, no better, no worse than any other tool; a compiler, a word processor, anything. A strapdown algorithm is as good or as bad as the man using it. Remember that.

From The 1953 The Paramount Pictures Corporation Movie *Shane*

(Joey talking to Shane who is working on fencing at the Starrett ranch)

Joey - You want me to tell you something?

Shane - If you want to.

- I saw your gun in there, one day. I took a look at it.

- Oh?

- Are you mad?

- No, I guess not. But if I were you, I'd leave a thing like that alone.

- I wrapped it up in the blanket again.

- That's a good boy.

- Could I see it again? You promised you'd show me how to shoot. Please!

- All right, Joey. Come on.

(Joey draws his toy wooden gun)

- Get 'em up!

- We've got some learning to do! Come on. You stand right here. All right, put your arms down to your side. Your holster's too low. Never have your holster at arm's length. Let's fix this. You always have it here, with the grip between the elbow and the wrist. So when your hand comes up, the gun clears the holster without coming up too high, see? Now you try it, real fast and straight. That's it.

- Gosh! Is that what real gunfighters do?

- No, Joey. Most of them have tricks of their own. One, for instance, likes a shoulder holster. Another one puts it in the belt of his pants. And some like two guns. But one's all you need if you can use it.....For putting a bullet where you want it.

- Which is the best way?

- What I'm telling you is as good as any, better than most.

- Let me see you shoot.

- What do you want me to shoot at?

- The little white rock over there, see?

(Shane fires several shots and the rock jumps from each.)

- Gosh, almighty, that is good!

- You see, Joey? Now look. Remember. When your hand comes up, you still clear your holster.

- Shane.

- Hello, Mrs Starrett. I was teaching Joey a little shooting.

- I don't want...

- You ought to see Shane shoot. He's teaching me.

- Yes, I know. Get ready for the party.

- Oh, Ma!

- Guns aren't going to be my boy's life.

- Why do you always have to spoil everything?

- A gun is a tool, no better or worse than any other tool, an axe, a shovel, anything. A gun is as good or as bad as the man using it. Remember that.