THE CONSULTANT

The Newsletter of the IEEE Consultants Network of Long Island

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Chairman's Corner – *Jerry Brown, Essex Systems*

Jerry sent out the following YouTube link:

http://www.youtube.com/watch?v=BRMAwXSbAnw&feature=related

showing a little old lady trying to follow instructions to install a DTV converter box between her rabbit-ear antenna and her old analog TV.

That was funny, but not so funny were some of the other videos that proclaimed the wonders of DTV via these converter boxes. They reminded me of a person's experience recounted in the October IEEE Spectrum, I think. Looked through my archive pile but couldn't find it, probably threw it out.

In summary, she hooked up a converter box to her favorite TV and couldn't get some channels that she wanted. Turns out that DTV is more fussy about signal strength and quality than the old analog system. Multiple power splitters and long lines with discontinuities just don't cut it, and maybe that old corroded antenna pointed in the wrong direction isn't helping, either. She needed a booster. Indoor rabbit ears in the suburbs? We'll see.

The YouTube videos that I watched went into detail about connecting the input and output cables of the converter, but just said to follow the instructions of the converter manufacturer when it came to setting up the channels. I have the impression that the fun starts there.

Enjoy, Dick LaRosa.

While editorializing, it is apparent from the introductions at our meetings that many of our members are producing hardware and software in a variety of new and old fields. Some are working with ideas that may become working hardware. The announcements and articles in the newsletter are a vehicle to make us aware of this tangible and intellectual output.

Meetings

August 6, 2008

Topic: "The Difference that Industrial Design Can Make in Engineering Projects"
Speaker: Eric Seger, Design Resources USA Inc.

September 3, 2008

Topic: "Embedded Linux Development for Power Architecture"
Speaker: Alex Peck, FAE, Freescale Semiconductor, Inc.

October 7, 2008 7 PM

Topic: "Ways to Succeed as an Engineering Consultant"
Panel Discussion by some of our Experienced Members.

November 5, 2008 7 PM

Topic: "Is LICN meeting the needs if its members?"
Open Discussion led by Peter Buitenkant

December 3, 2008

Topic: "Ultrasound Imaging in Medical Application: Fundamantals and Current Technology"
Speaker: Howard Fidel, Senior Engineer, Schick Technologies
Times: 6:30 PM refreshments available.
7:00 PM LICN business meeting begins.
7:30 PM Presentation begins.
Place: Briarcliffe College, Great Room
1055 Stewart Avenue, Bethpage, NY.
Fee: $20 for PEs receiving CEUs. Pay at meeting. (0.1 CEU)
Registration for CEUs: Visit calendar page of www.ieee.li, click on registration link, fill out form.
Guests are welcome. No charge. No preregistration, but email jlbrown@essexsys.com so we can order refreshments.

Directions: See our website www.consult-li.com.

Other Meetings

Consult the Events Calendars on the Section website: www.ieee.li and the LICN site: www.consult-li.com

Remember to inform the members about seminars and other items that might be of interest. E-mail them at members@consult-li.com.

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A Lower-Cost Hybrid Approach — *Carl E. Schwab*

In a recent article for the Newsletter I noted that although the Prius is selling well, the other hybrid offerings by the several companies, including Toyota, are not selling well. The implied reason is the "premium" charged by the manufacturers is too high and I offered anecdotal comment.

Alternatively, the manufacturers are attempting to make the hybrid a "luxury" car and thus justify the higher price and hopefully avoid the calculation of a payback period.

What follows is a bit different approach.

Whether the hybrid is "parallel" or "series", there are certain fixed costs associated with mechanisms that people don't initially even consider. This is
best explained by examples.

Example: Let us consider a "parallel" case. We will configure this "parallel" by starting with a conventional ICE and CVT or automatic transmission. This transmission output shaft will drive through a differential to either the front wheels (constant velocity joints) or the rear wheels.

Now to make this a hybrid we will couple a mot/gen, through a clutch pair so that the mot/gen can be coupled to the driven wheels. It is this extra paraphernalia, plus the required VVVF (Variable Voltage, Variable Frequency) drive, its control circuits and a battery that are added.

Clearly there is additional physical hardware, hence additional cost to make this hybrid.

Another Example: Let us now consider a "series" case. In this case we drive the wheels only with the mot/gen. Again to drive the wheels we need a differential and constant velocity joints for front wheel drive. Because the ICE is operated at a constant rpm, we will not need the CVT or automatic transmission. Also the ICE is ultra clean. We will need an alternator plus the battery.

This is not unlike the GM VOLT which has a differential and constant velocity joints for the front wheels. Another interesting point about the VOLT is it is 4-wheel drive but the rear wheels rather than through a differential, are driven by separate motors. So the cost trade here is an additional mot/gen for the rear differential.

In the B section of the WSJ, dated September 24, 2008, is an article entitled, "Chrysler's Jolt: Three Electric Cars". (I think a pun intended). But the point is, Chrysler announced three electric drive cars that bear resemblance to the GM VOLT. They have expanded to include a sporty Dodge "Gee Whiz", an SUV based on the Jeep Wrangler, and a Chrysler Van. The first is electric only with a claimed range of 150 to 200 miles per charge; the remaining two have an ICE plus alternator package to provide extended range up to 400 miles beyond the initial 40 miles as a PHEV.

The point is GM with the VOLT is not alone; they now have company giving the public more choices.

More thoughts: To the writer, the VOLT, plus the Chrysler proposed offerings, are sort of half-a-loaf in the sense one differential has been eliminated by using a second mot/gen. With this configuration, if the mot/gen are driven by synched VVVFs then the rear wheels have an anti-slip differential action. Remember we are trying to design a lower cost hybrid and the cost/reliability model is, "Nothing costs less nor is more reliable than the part that is not there". Why not take this further?

What the writer proposes: What the writer proposes is 4WD + 4WS scheme that will eliminate 1) the automatic transmission or CVT, 2) both front and back differentials, 3) will achieve anti-slip traction on all wheels, 4) provide maximum BER braking.

What is 4WS? This is 4-wheel steering. This is being offered because it costs very little in hardware and the recurring cost is just software. Each of the four wheel assemblies are IDENTICAL and consist of a mot/gen, coupling shaft with a constant velocity coupling on one end and a universal on the other, two "A" frames with ball joints and coil or torsion bar links for suspension plus shocks. Each of these four mot/gen will need its own VVVF, again IDENTICAL.

The idea behind 4WS is that for given wheel steering deflection, the turning radius is reduced by 50%. The 4WS idea is NOT new and in fact briefly marketed by a Japanese company about 25 years ago. It was withdrawn due to complexity and cost. It did demonstrate improved low speed maneuvering and easy parking both parallel and head-in.

How does this reduce cost?

Things that are not required;

1) No differentials
2) No CVT/automatic transmission
3) No Large displacement ICE with anti-pollution paraphernalia.
4) The ICE operation is ultra clean.

Simplifications

1) It reduces the number of different mechanical parts that have to be manufactured/assembled.

2) The parts require less mechanical skill to assemble hence lower labor costs. The unions will (and likely do) hate this design.

3) Factories can be designed along the Honda model where they can competitively "batch" several different type vehicles. Honda can "batch" as few as 100 units by using robots with "interchangeable hands".

An Aside: Wheel assembly damage is very common in collisions. I checked with a friend, Sal, who owns a "collision repair" shop, to get an estimate of cost for a front end replacement kit. I used a '95 Ford Taurus for an example. Sal confirmed there are many small manufacturing shops that "supply-to-order", complete kits for almost any car.

Upshot was, a right or left front wheel assembly for a '95 Taurus was $725 and included, 1) the hub and bearing, 2) the brake rotor and caliper, 3) the CV joint, 4) the upper and lower ball joints, 5) upper and lower "A" frames, 6) the steering drag link. Did not include rim, lug bolts or tire.

The pricing policy was "buy three, get one free". So for 3 x 725 = $2175 you have major portions of what runs on the ground. Remaining are the suspension coil spring, and shock absorber for each wheel.

Another Aside -- Alternate mot/gen method of construction: An interesting method widely used for normal car alternator uses the Lundell – claw pole form for the rotor. In our case we want to have a rotor that has 5 pole-pairs, and can be efficient in a "pancake" shape since we will have two of the mot/gen, back-to-back for both the front and rear wheels. In this configuration, the north and south claw-pole each will have 5 fingers before forming. This configuration produces a high torque, low rpm mot/gen that matches well for direct drive to the respective wheel.

When used as a VFSM, at 60 Hz the rotor rpm will be 720 rpm; a close match to the 760 wheel rpm at 60 mph. What is unknown is the efficiency as a VFSM at the 5-20Kw output range, i.e. will it match a conventional 5 pole-pair salient rotor? It is certainly less expensive and certainly should be considered in achieving a lower cost hybrid.

Conclusion

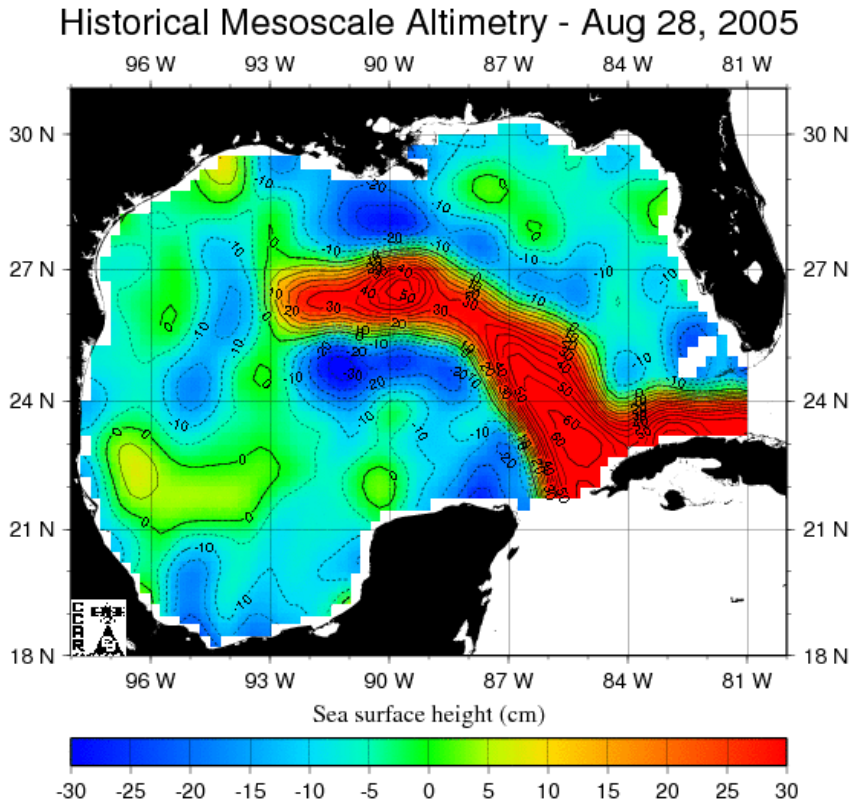
With the items listed above, it does appear that a significantly lower cost hybrid can be built and should be very competitive (even lower in cost) than a conventional car. Just on price alone the vehicle should attract a large following. The added features of 4WD+4WS will make it a pleasure to drive and very safe in raining and/or icing conditions.

THIS COULD BE A REAL WINNER!

Next article begins on following page. I couldn't figure out how to put it here.

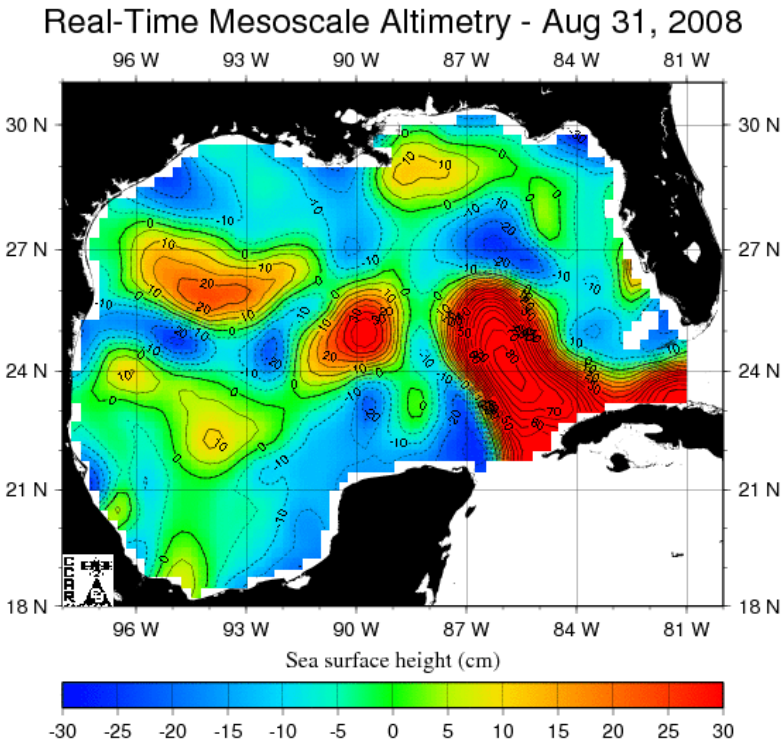
The LOOP CURRENT and its EFFECT ON HURRICANES

---- Dr. Richard LaRosa
sealevelcontrol.com



The picture at the left comes from the website of the Colorado Center for Astrodynamics Research, Dept. of Aerospace Engineering Sciences, University of Colotrado, Boulder. The easiest way to access this data is to google "sea surface height" and select "Gulf of Mexico Near Real-Time Altimeter Data Viewer". You can select any date. For this picture, I selected the day that Hurricane Katrina was a Category 5 roaring up that red area heading for New Orleans.

The color scale below the map of the Gulf of Mexico shows that the sea surface in the red area is elevated above the surrounding area. In fact, the peak height contour is 60 cm. The raw altimetry data would not produce the pictures on this page. The sea surface height is affected by the depth of the



water and the density of the solid earth below. These influences and many others must be subtracted out in order to display the influence of the Loop Current. The Loop Current enters the Gulf of Mexico (GOM) between the Yucatan Peninsula and the western tip of Cuba. It follows the edge of the red area all the way around and exits the GOM between the Florida Keys and the north coast of Cuba. Most maps call this region the Florida Straits. Note that the portion of the loop which intrudes into the GOM resembles a narrow hairpin.

The second picture shows sea surface height contours around the time that Hurricane Gustav was a Category 4 passing through the red area. In addition to its elevated surface height, the red area is also a deep pool of warm water because the Coriolis force, which deflects the Loop Current water to the right of its path, is proportional to the velocity of the water. Due to thermal stratification, the warmest water is closest to the surface, so it also has the greatest velocity. Therefore, the warmest water is deflected into the red area, and it forms a pool of warm water about 200 meters deep..

A hurricane passing through the red area sucks warm water into its eyewall because of the low atmospheric pressure at the center of the hurricane. The high wind breaks the water into a fine spray which provides the surface area needed to evaporate water at a rate sufficient to energize the hurricane.

In order to make landfall in New Orleans (identified by the Mississippi Delta protruding into the GOM) both Katrina and Gustav had to leave their respective warm pools and cross water that is colored blue in the map. Remember that the blue color indicates a lower sea surface height, but not necessarily a lower temperature. Referring to the pictures, note that Katrina traveled a shorter distance than Gustav after leaving the Loop, and most of Katrina's terminal path was over shallow solar-heated shelf water. Katrina was Category 3 at landfall, but the storm surge was due to the Category 5 history.

Gustav, on the other hand, traveled a longer path after leaving the Loop, and a good portion of this path contained cool water underneath the shallow solar-heated surface layer. Therefore, Gustav was able to pull up cool water that reduced it to Category 2 at landfall. New Orleans suffered little damage from Gustav, whereas Katrina was devastating. Many people credit the rebuilt levees and other improvements for the better outcome in 2008. It appears to me that it was more a matter of luck. Many factors influence the size and intensity of a hurricane. Gustav was lower intensity than Katrina when each one left the Loop, and Gustav passed over more cold water on the way to New Orleans. Data is available on the intensity and paths of previous hurricanes, and the position of the Loop Current when each of them passed through it. These must be examined to see if they are consistent with the idea that the proximity of the Loop Current to the targeted landfall area is an important parameter.

However, I am presently more interested in understanding the behavior of the Loop Current itself. Some questions that need answers are:

1. Why does it always seem to be in the form of a narrow hairpin? Perhaps the Coriolis force, in deflecting water toward the inside of the loop, pulls the two legs of the hairpin toward each other. Sometimes they touch and a closed ring is formed. The ring may detach and drift toward the west, or the "short circuit" may open up and restore the original loop configuration. If the closed ring drifts westward, it assumes a circular configuration, like the two rings in the second picture.

2. What force drives the Loop Current? Henry Stommel, in his 1965 book on the Gulf Stream, referred to a 19 cm hydrostatic head that overcomes friction in the GOM outlet to the Atlantic Ocean. This was based on a leveling survey across the Florida Peninsula. I have seen this 7.5 inch level difference in earlier books. Tides, waves, and wind-driven water pile-ups complicate this measurement and I have not found anybody willing to discuss it. It is hard for me to imagine any force but gravity driving the Loop and Florida Currents. Therefore, I have assumed a hydrostatic head h that provides the potential energy to overcome friction losses in the Loop and Florida Current. I have to ignore complications like tides, wind, waves, and surges because I don't know what to do with them.

3. How would the power extracted by turbines in the Antilles passages affect the volume transport, kinetic energy transport, momentum transport, and friction dissipation of the Loop and Florida currents? How would it affect the hydrostatic head h, and how would it affect the penetration of the Loop Current into the GOM? The latter seems to be a critical factor in the destructiveness of a hurricane to the Gulf coast. I am arriving at answers through the liberal use of approximations, speculation, and over-simplification. This will have to suffice for a first look at what may turn out to be a way to reduce the devastation of hurricanes in the GOM.