

# ADAPTIVE FORCE-LIMITING SEAT BELTS FOR OCCUPANT CRASH PROTECTION

Fall Semester 2007  
TR 12:30pm-1:45pm, Shultz 105

## Introduction:

One of the unintended consequences of seat belts in a crash are rib fractures from the belt loading. Rib fractures are most common for occupants with fragile skeletons, e.g., the elderly or women with osteoporosis. To combat this injury risk, some newer model cars are now being equipped with force-limiting seat belts – a very clever enhancement to standard seat belts which caps the force transmitted to the thorax in a crash.

But all occupants do not have the same injury tolerance. A 70 year old female driver has a much more fragile skeleton than a 22 year old male. What is needed is a force limiting seat belt which can adapt to the occupant. A second constraint is that because force-limiting seat belts tradeoff lower chest loads for greater forward motion, an overly soft force-limiting seat belt may allow more head strikes. There may be an advantage to 'turning-off' the force limiting for lower speed crashes.

## Objective:

The objective of this project is to design, build, and test an advanced force-limiting seat belt system which can adapt to the injury tolerance of the occupant and the severity of the crash. Tasks will include:

- (1) Reverse engineering of current force-limiting seat belt systems
- (2) Evaluation of competing force-limiting designs in bench-scale tests
- (3) Design and testing of an advanced force-limiting belt system
- (4) Reporting

**Instructor:** Professor H. Clay Gabler  
Office: 100-F Randolph Hall  
Phone: 540-231-7190  
email: gabler@vt.edu

## COURSE ORGANIZATION and GRADING SYSTEM

1.	Course Coordinator assessment (Dr. Terpenney) Attending her lectures, her quizzes etc	15%
2.	Faculty advisor assessment (Dr. Gabler) Quizzes, assignments from Dr. Gabler	35%
3.	Midterm Deliverable (presentation and report)	
	Presentation (Dr. Gabler)	10%
	Report (Dr. Gabler)	10%
	Report (Dr. Terpenney)	5%
4.	End-of-term Deliverable (presentation and report)	
	Presentation (Dr. Gabler)	10%
	Report (Dr. Gabler)	10%
	Report (Dr. Terpenney)	5%

**Total:** 100% (Dr. Gabler = 75%, Dr. Terpenney 25%)

Grades will be based most likely on the following scale; however, the instructor reserves the right to curve the grades up or down based on the overall class performance:

92 +	A;	90 – 92	A-;	88 – 90	B+;	82 – 88	B;	80 – 82	B-;
78 – 80	C+;	72 – 78	C;	70 – 72	C-;	68 – 70	D+;	62 – 68	D
60 – 62	D-;	0 – 60	F						

### COURSE POLICY:

- Attendance at all classes is mandatory.
- No late assignments will be accepted.
- Extra credit: Attending a guest lecture (outside of class time) and asking a question. We will have these periodically throughout the semester.