



CALTECH
Control & Dynamical Systems

Marsden Slide Package

Template

Jerrold E. Marsden
Control and Dynamical Systems
Caltech

Itemized Headline Levels

■ *Newpage First headline level item*

using commands: `\item\pause`

- second headline level item
- second headline level item 1
- second headline level item 2

$$y = \alpha + \beta$$

- *third headline level item 1*
- *third headline level item 2*
 - fourth headline level item 1
 - fourth headline level item 2
 - fourth headline level item 3

Itemized Headline Levels

- fourth headline level item 4
- fourth headline level item 5
- fourth headline level item 6
- third headline level item 3
- third headline level item 4
- second headline level item 3
- second headline level item 4
- *First headline level item 2*
- *First headline level item 3*

Figure Captions

image

Caption $x = \frac{1}{2a} \left(-b \pm \sqrt{b^2 - 4ac} \right).$

Movie Page

name of movie to insert

To add this place-marker for movie insertion, use the command

```
\MoviePage{name of movie to insert}
```

or

if you are running this on a Linux System that cannot run Quicktime Player or other movie software from the PDF file with Acrobat Reader, make a hyperlink using “\href{Pathtomovie} {HyperlinkTitle}” to your movie and run it offline in your browser.

Text & Graphics

*Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?*

—T. S. ELIOT (1888–1965)



Small Rose

Code for inserting graphics

```
\begin{minipage}{0.5\textwidth}  
\begin{center}  
\includegraphics{SmallRose}\  
\TextCcaption{\small Small Rose}  
\end{center}  
\end{minipage}
```

General Theory of Relativity

When you sit with a nice girl for two hours, it seems like two minutes.

When you sit on a hot stove for two minutes, it seems like two hours.

That's relativity. —ALBERT EINSTEIN

After 1905, Einstein continued working in all three of his works in the 1905 papers. He made important contributions to the quantum theory, but increasingly he sought to extend the special theory of relativity to phenomena involving acceleration. The key to an elaboration emerged in 1907 with the principle of equivalence, in which gravitational acceleration was held a priori indistinguishable from acceleration caused by mechanical forces; gravitational mass was therefore identical with inertial mass. Einstein elevated this identity, which is implicit in the work of Isaac Newton, to a guiding principle in his attempts to explain both electromagnetic and gravitational acceleration according to one set of physical laws. In 1907 he proposed that if mass were equivalent to energy, then the principle of equivalence required that gravitational mass would interact with the apparent mass of electromagnetic radiation, which includes light. By 1911, Einstein was able to make preliminary predictions about how a ray of light from a distant star, passing near the Sun, would appear to be attracted, or bent slightly, in the direction of the Sun's mass. At the same time, light radiated from the Sun would interact with the Sun's mass, resulting in a slight change toward the infrared end of the Sun's optical spectrum. At this juncture Einstein also knew that any new theory of gravitation would have to account for a small but persistent anomaly in the perihelion motion of the planet Mercury.



Albert Einstein

General Theory of Relativity

About 1912, Einstein began a new phase of his gravitational research, with the help of his mathematician friend Marcel Grossmann, by phrasing his work in terms of the tensor calculus of Tullio Levi-Civita and Gregorio Ricci-Curbastro. The tensor calculus greatly facilitated calculations in four-dimensional space-time, a notion that Einstein had obtained from Hermann Minkowski's 1907 mathematical elaboration of Einstein's own special theory of relativity. Einstein called his new work the general theory of relativity. After a number of false starts, he published the definitive form of the general theory in late 1915. In it the gravitational field equations were covariant; that is, similar to Maxwell's equations, the field equations took the same form in all equivalent frames of reference. To their advantage from the beginning, the covariant field equations gave the observed perihelion motion of the planet Mercury. In its original form, Einstein's general relativity has been verified numerous times in the past 60 years, especially during solar-eclipse expeditions when Einstein's light-deflection prediction could be tested.

Photo and text courtesy of <http://www.humboldt1.com/gralsto/einstein/einstein.html>

picinpar

Inserting pictures in paragraphs as shown on the previous page is possible using the package `picinpar.sty`. (See *The L^AT_EX Companion* by Michel Goossens and Frank Mittelbach, Addison Wesley, 1994.) The code to create the preceding page is:

```
\begin{footnotesize}
\begin{window}[2,r,%
{\fbox{\includegraphics{einstein}}},%
```

General Theory of Relativity

```
{\hfill\tiny Caption...\hfill}]
```

```
Put text to surround picture window here ...
```

```
\end{window}
```

```
\end{footnotesize}
```

References

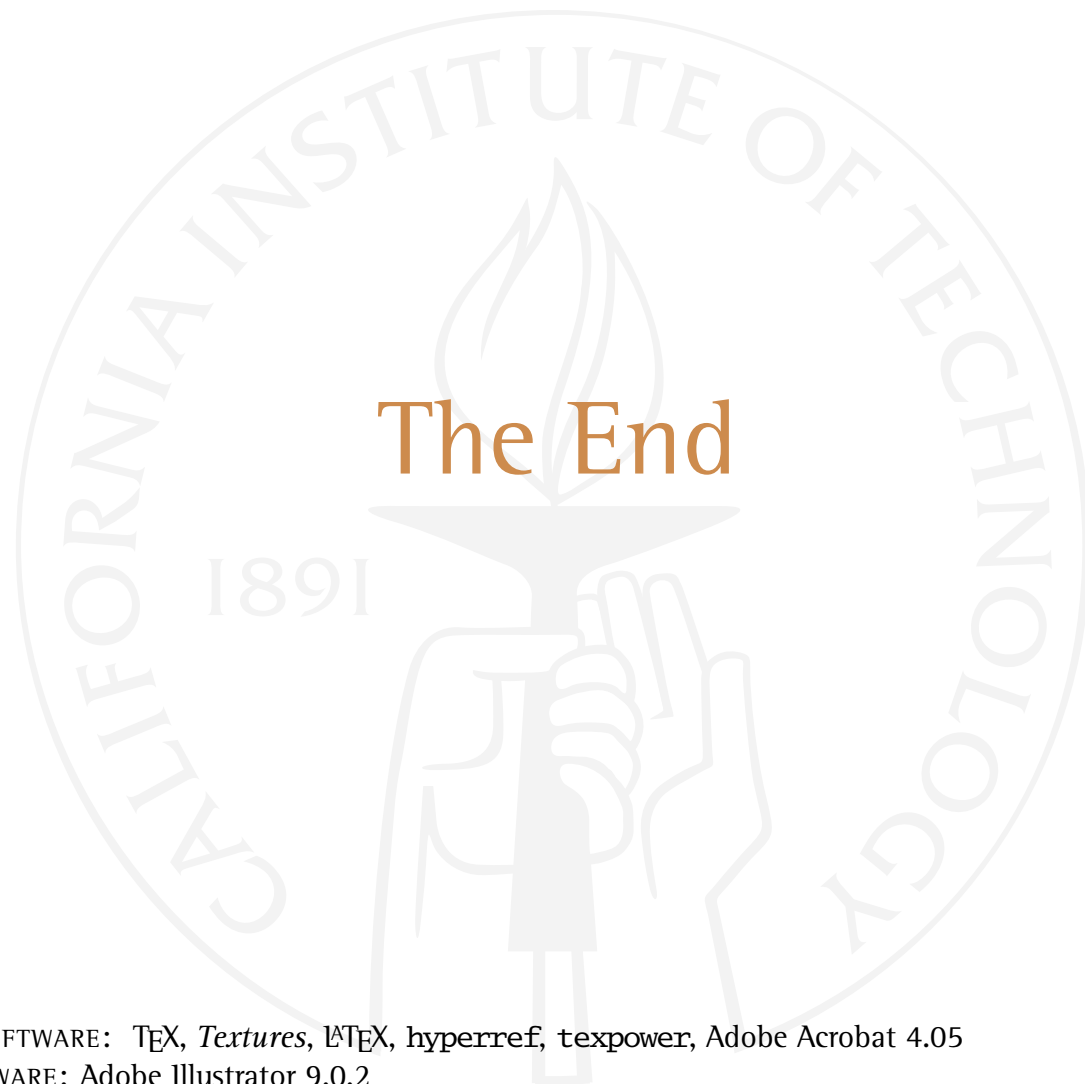
- Koon, W. S., M. Lo, J. E. Marsden and S. Ross, Heteroclinic Connections between periodic orbits and resonance transitions in celestial mechanics, *Chaos*, **10**, (2000), 427–469.
- Marsden, J. E., T. S. Ratiu and J. Scheurle, Reduction theory and the Lagrange–Routh equations, *J. Math. Phys.*, **41**, (2000), 3379–3429.

■ Code

NOTE: Do not add `\pause` in the list of references. The command `\refitem` will produce bulleted items in a reference list.

```
\begin{description}
\refitem
  \href{http://www.cds.caltech.edu/~marsden/stc/KoLoMaRo2000_abs/}
  {Koon, W.~S., M.~Lo, J.~E.~Marsden and S.~Ross},
  Heteroclinic Connections between periodic orbits and resonance
  transitions in celestial mechanics,
  \textit{Chaos}, {\bf 10}, (2000), 427--469.

\refitem
  \href{http://www.cds.caltech.edu/~marsden/stc/MaRaSc2000_abs/}
  {Marsden, J.~E., T.~S.~Ratiu and J.~Scheurle},
  Reduction theory and the Lagrange--Routh equations,
  \textit{J.~Math. Phys.}, {\bf 41}, (2000), 3379--3429.
\end{description}
```



TYPESETTING SOFTWARE: $\text{T}\epsilon\text{X}$, *Textures*, $\text{L}\text{T}\epsilon\text{X}$, *hyperref*, *texpower*, Adobe Acrobat 4.05
GRAPHICS SOFTWARE: Adobe Illustrator 9.0.2
 $\text{L}\text{T}\epsilon\text{X}$ SLIDE MACRO PACKAGES: Wendy McKay, Ross Moore